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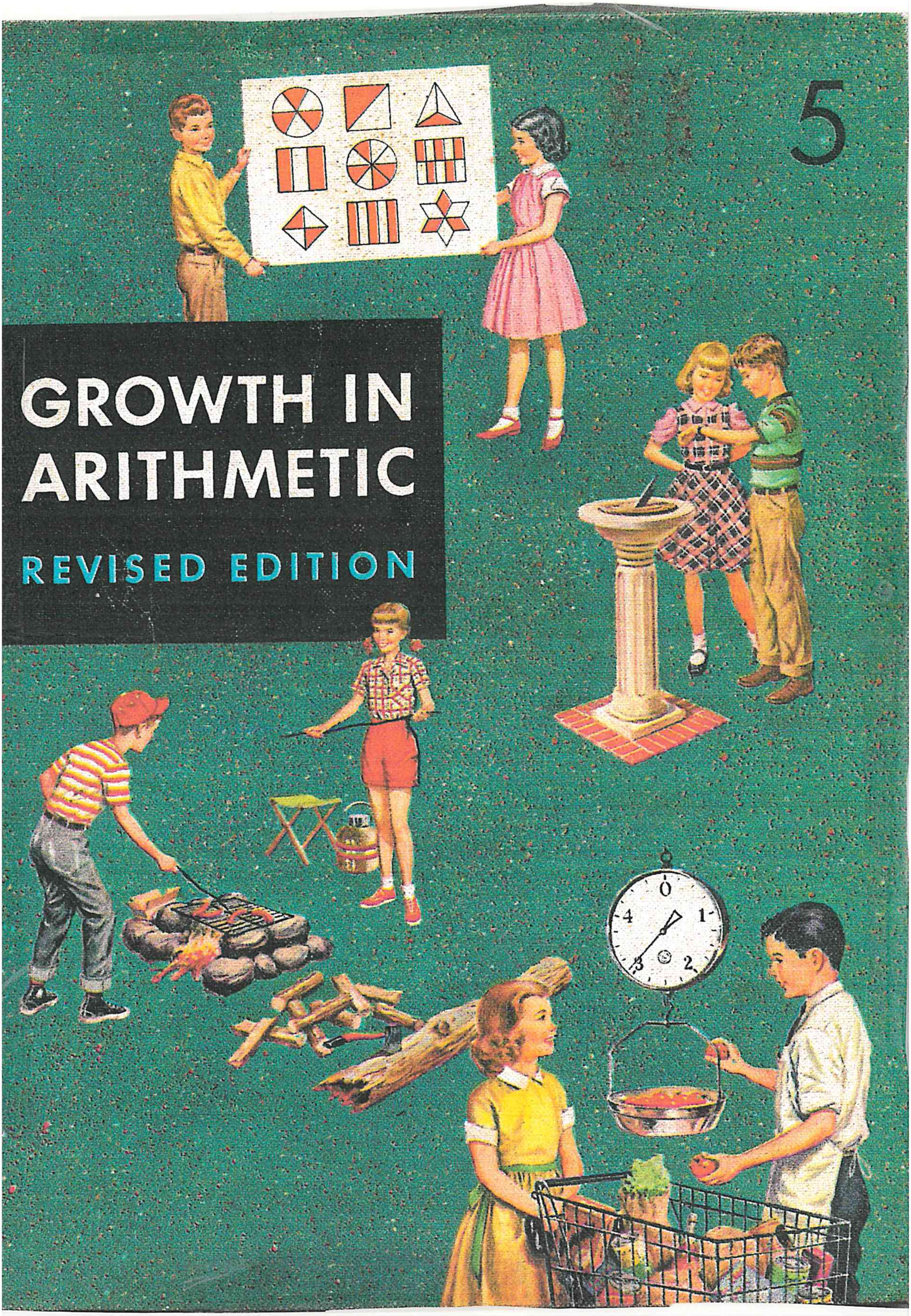
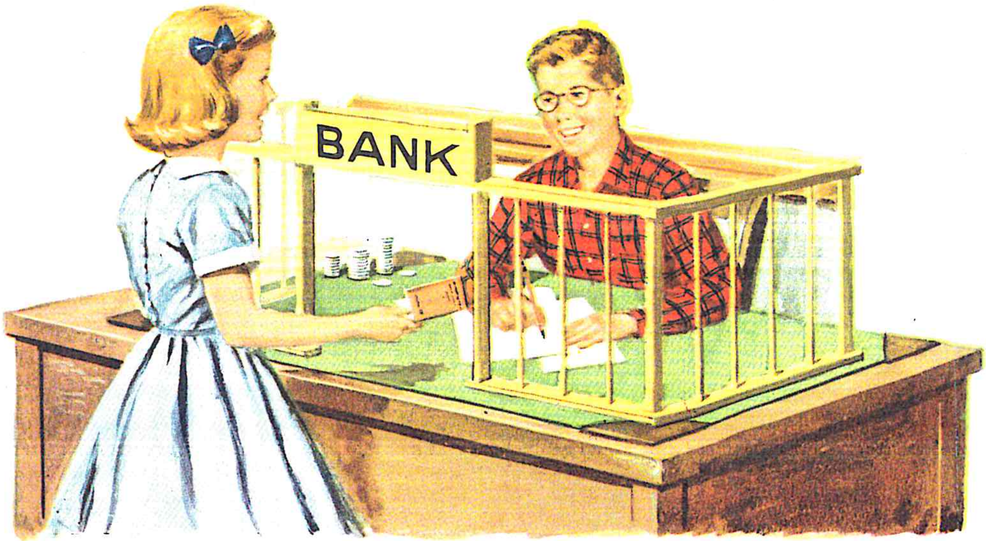
GROWTH IN ARITHMETIC

REVISED EDITION



GROWTH



REVISED EDITION • **GRADE FIVE**

IN ARITHMETIC

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Contents


HIGHLIGHTS OF WASHINGTON

Meaning of millions. Place value. Reading and writing numbers up to and above a million

UNIT 1

The meaning of million

Miss Weaver's fifth-grade pupils went to visit the Bureau of Engraving and Printing in Washington, D. C. They wanted to learn about the paper money we use in the United States and to see how it is printed.

1. After their trip they made the chart below. Count the money in each row of the chart to help you find the missing numbers below.

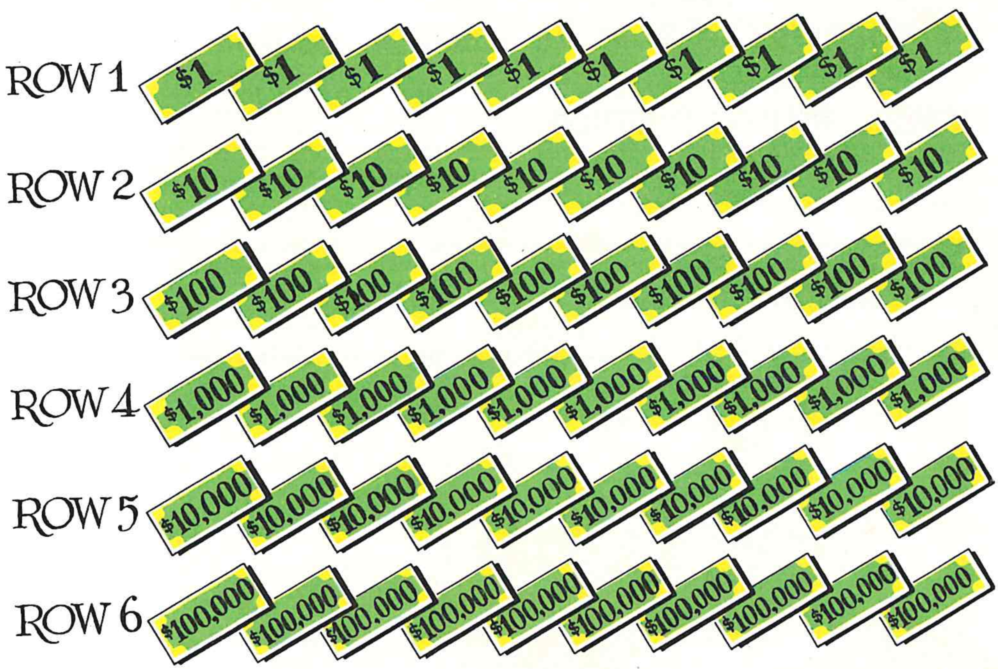
- Row 1 shows _?_ 1-dollar bills, or _?_ dollars in all.
- Row 2 shows _?_ 10-dollar bills, or _?_ dollars in all.
- Row 3 shows _?_ 100-dollar bills, or _?_ thousand dollars in all.
- Row 4 shows _?_ 1,000-dollar bills, or _?_ thousand dollars in all.
- Row 5 shows _?_ 10,000-dollar bills, or _?_ thousand dollars in all.
- Row 6 shows _?_ 100-thousand-dollar bills, or _?_ thousand dollars in all.

A thousand thousand dollars is a *million* dollars.

2. Explain how Row 6 teaches you these two facts:

- A million is a thousand thousand.
- A million is 10 times 100,000.

3. Use Row 6 to find how many there are in half a million.



The meaning of a million

1. Bob says each number in the table is 10 times the one above it. Is he right? Tell 5 things the table teaches.

\$1	= one dollar
\$10	= ten dollars
\$100	= a hundred dollars
\$1,000	= a thousand dollars
\$10,000	= 10 thousand dollars
\$100,000	= 100 thousand dollars
\$1,000,000	= 1,000 thousand dollars, or a *million* dollars

2. Bob says he can show that a million means 1,000 thousand. To do this, he covers the last three zeros in 1,000,000. Explain.

3. \$153,072 is made up of:

1 hundred-thousand-dollar bill
5 ten-thousand-dollar bills
3 thousand-dollar bills
_?_ ten-dollar bills
_?_ one-dollar bills

4. How would you give the following amounts? Use as few bills as possible.

\$9,245	\$92,056	\$638,253
\$70,000	\$300,000	\$706,750
\$70,562	\$357,289	\$1,000,000

One day Tom went to the school supply warehouse. He looked at the shelves shown on the next page and figured there were a million sheets of paper on the shelves.

Do Exs. 1–11 with the help of the picture, and prove that Tom was right.

5. 1 package holds _?_ sheets.

6. 1 box of paper contains _?_ packages. Point to the packages in the box and count the number of sheets by 1,000's. Each box contains _?_ sheets.

7. Point to the boxes on the top shelf and count the number of sheets by 10,000's. One shelf contains _?_ sheets.

8. Point to the shelves and count the number of sheets by 100,000's. On the 10 shelves there are _?_ sheets.

Ten times 100,000 is a *million.*

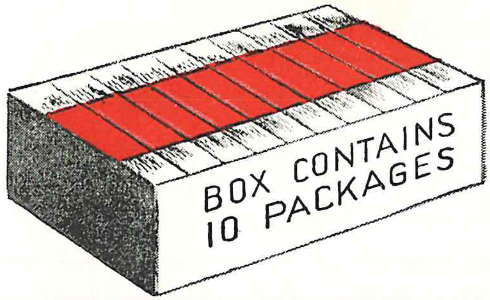
9. It takes _?_ boxes of paper to make a million sheets.

A million = _?_ ten-thousands.

10. It takes _?_ packages to make a million sheets.

A million = _?_ thousands.

11. There are _?_ thousand sheets in half a million.



1. Show that each of these facts about a million is true:

- When you count by hundred thousands, a million comes next after 900,000.
- To write a million, you write a 1 with six zeros after it.
- A million is a ***7-figure,*** or a ***7-place,*** number.
- A million is 1,000 thousand; a million is 10 times 100,000.
- When you are counting by thousands, a million comes next after 999,000.

2. Count by 50,000's to 500,000.

3. 900,000 + ? = 1,000,000
999,000 + ? = 1,000,000
999,999 + ? = 1,000,000
500,000 + ? = 1,000,000

4.

$$\begin{array}{r} 9 \\ +1 \\ \hline \end{array} \qquad \begin{array}{r} 99 \\ +1 \\ \hline \end{array} \qquad \begin{array}{r} 999 \\ +1 \\ \hline \end{array}$$

$$\begin{array}{r} 9{,}999 \\ +1 \\ \hline \end{array} \qquad \begin{array}{r} 99{,}999 \\ +1 \\ \hline \end{array} \qquad \begin{array}{r} 999{,}999 \\ +1 \\ \hline \end{array}$$

5. When you are counting by ones, what number comes next after 999,999?

A population map

Every ten years the United States Government counts the people living in the United States. This counting of persons is called *taking the census*.

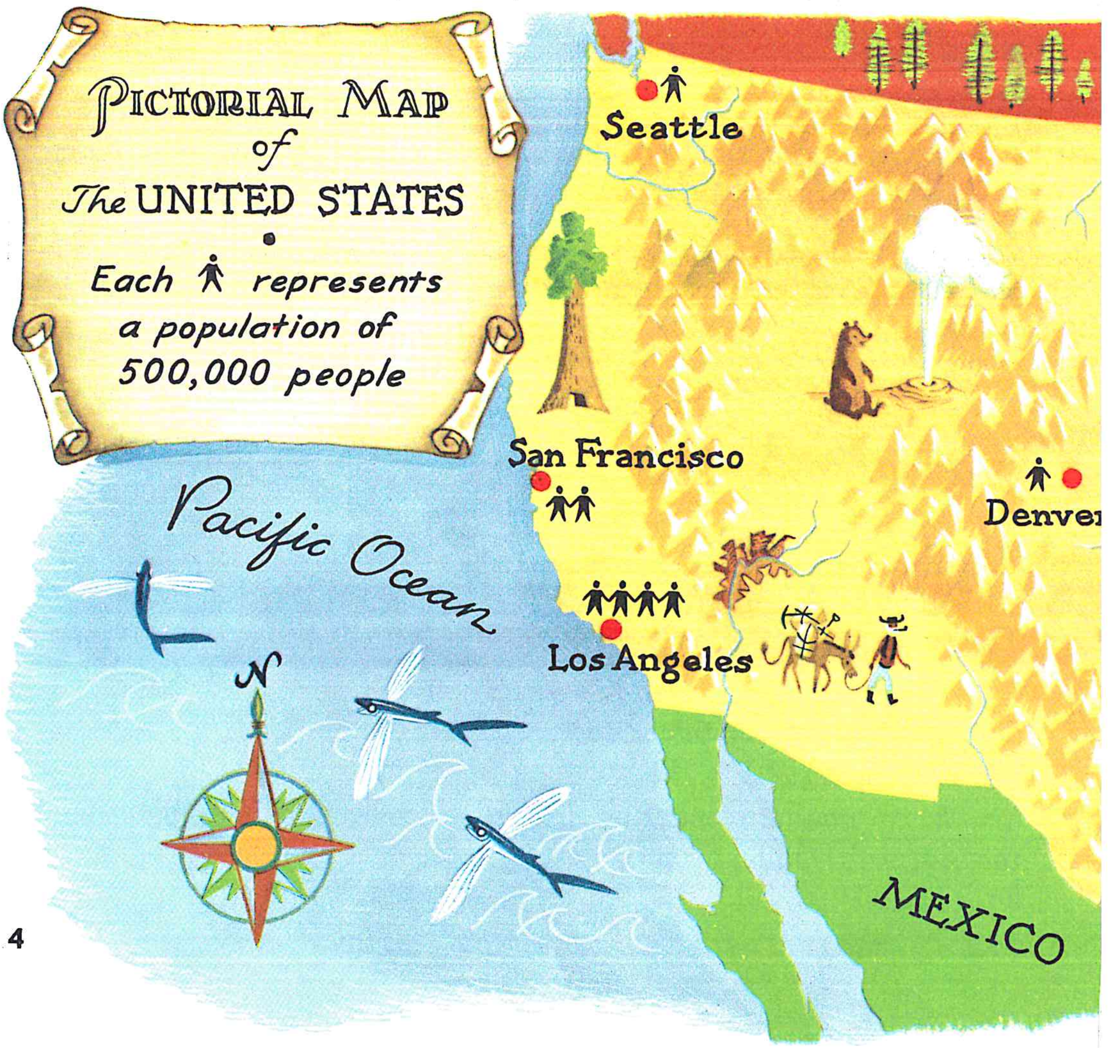
Men and women are hired by the U.S. Government to go around in each community and find out the number of persons living in each house.

These men and women are called *census takers*.

1. The first census was taken in 1790. Try to find out when the last census was taken. How many years ago was that?

How old were you when the last census was taken?

2. When the last census was taken, what was the population of your state? What was the population of your county? of your village or city?



3. Below is a picture map of the United States, showing the population of some of the large cities.

Each little man on the map represents about _?_ persons.

4. A glance at the map tells you that _?_ is the largest city, _?_ is the second largest city, and _?_ is the third largest city.

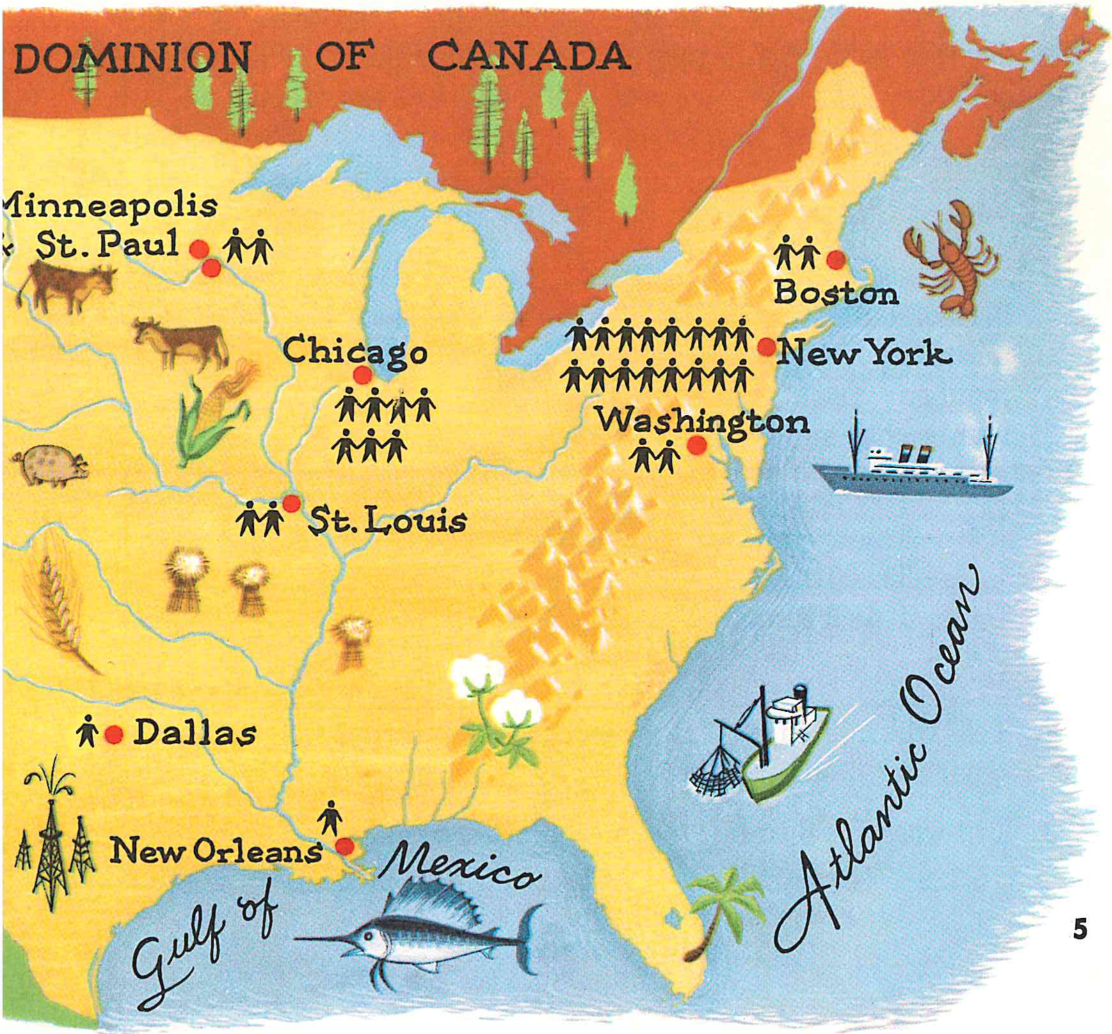
5. Which cities shown on the map have a population of about 500,000 persons?

6. What is the population of St. Louis? of Boston?

7. Do 500,000 and 500,000 together make a million?

8. Count by 500,000's to find the population of Los Angeles; the population of Chicago; the population of New York.

9. Can you tell from the map whether the population of Dallas is larger or smaller than the population of New Orleans?



Number discoveries

1. Tom can take numbers apart and put them together again. When he takes 53,246 apart, it looks this way: →

50,000
3,000
200
40
6

Show by adding the parts how the number looks when he puts it together again.

2. Take apart 4,872. Put it back together again by adding the parts.

3. Charley said, "If I take 5 one-hundred-dollar bills out of $246,591, the amount that is left is $246,091."

Prove that Charley is right.

4. Write the number that is left when you take:

- 6,000 out of 56,243.
- 40 out of 9,640.
- 200 out of 143,208.
- 3 out of 96,453.

5. If you change the 6 in 5,642 to a zero, the new number is _?_ smaller than the old.

6. Using the figures 5, 3, 9, 1, 7, write the largest number you can.

The number 324,462,758 is read: 324 *million*, 462 *thousand*, 758.

In writing 324,462,758 commas are placed after the millions and after the thousands.

George discovered that any figure, such as 3, has different meanings. The meaning depends on what place 3 has in a number. Look at this number: 3,333,333. Each 3 in the number has a different meaning.

This 3 stands for 3 millions — 3,000,000
This 3 stands for 3 hundred-thousands — 300,000
This 3 stands for 3 ten-thousands — 30,000
This 3 stands for 3 thousands — 3,000

3,333,333

7. Tell which 3 in the number 3,333,333 stands for 3 hundreds; for 3 tens; for 3 ones.

8. Tell what the 6 stands for in each of these numbers:

6,329   61,243   7,846   197,628   51,268

Reading and writing numbers

1. Tell what each figure stands for in the numbers below.

Then take the numbers apart and put them back together again as Tom did in Ex. 1, page 6.

27,653	916,284	4,265,879
47,682	897,624	7,286,493

2. Read each number in Ex. 1.

3. When Miss Robinson said, "Write the number '8 thousand, seventy-five,'" Ellen wrote it this way: 8,075.

The zero means that there are no hundreds in the hundreds place. The number is eight thousand and just seventy-five more.

Read these numbers. Tell what the zero in each means:

2,704	3,860	70,243	82,067

4. Read these numbers:

54,390	4,007,006	3,490,100
909,900	3,604,308	23,456,789
8,000,009	2,002,202	30,604,905

5. Your teacher will dictate the numbers in Ex. 4 for you to write.

Be sure to write a comma when she says "million" and when she says "thousand."

6. What number is 10,000 more than 382,956?

7. What number is 100,000 less than 782,950?

8. Copy: 4321507. To place commas in the number, you begin with the 7 in ones place and count to the left, saying:

"Ones, tens, hundreds, *write comma;* thousands, ten thousands, hundred thousands, *write comma.*" Read the number.

9. Copy these numbers on the blackboard, place commas, and read:

736452	2345678	5304708
300300	40004000	2020202
1111111	63704618	10000000

10. One newspaper said, "Our town spent $\$2\frac{1}{2}$ million last year." Another newspaper reported, "Our town spent \$2,500,000 last year."

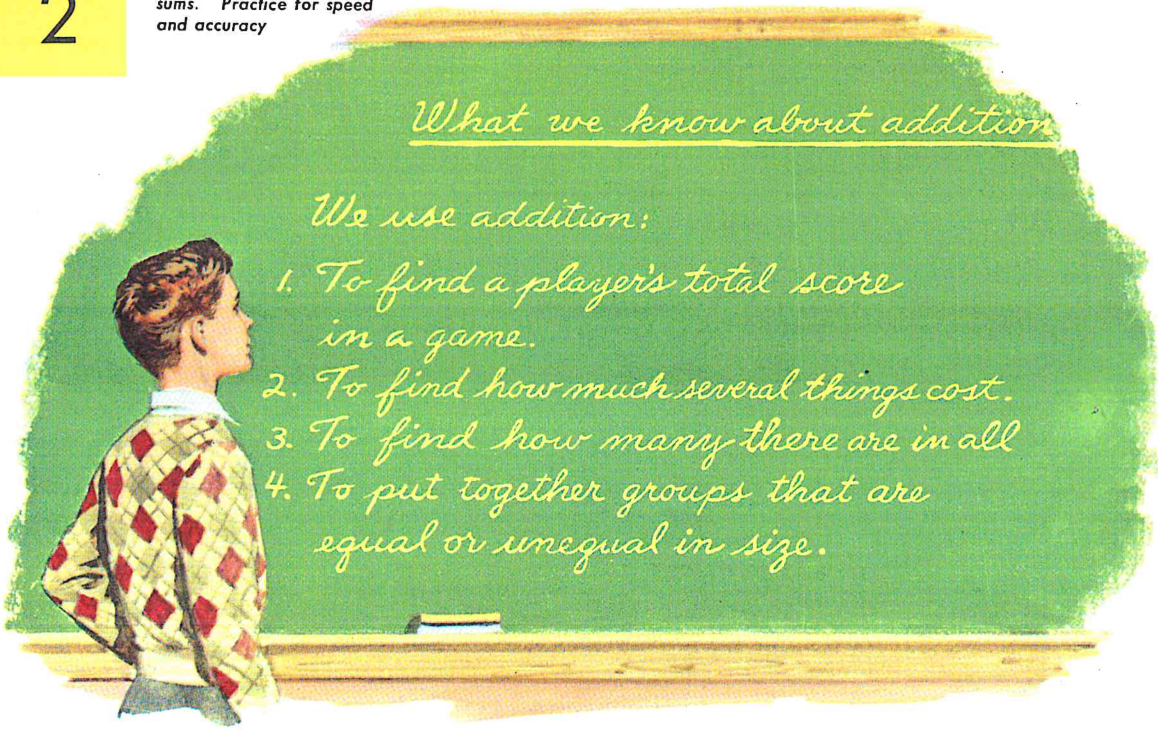
Can you show that the amounts are the same?

11. Joe got 96,254 for the answer to an addition. The 6 should have been a 7. His answer was __?__ too small.

12. Find illustrations of the use of large numbers in newspapers, magazines, geography books, and science books.

UNIT 2

Meaning and use of addition. Adding mentally. Estimating sums. Practice for speed and accuracy



The meaning and use of addition

1. Look at the picture. What kinds of questions can Miss Bailey's fifth-grade class answer by addition?

2. Do you ever need to add? Tell about your needs for adding.

3. What does adding mean?

4. What do you have to be careful about in writing the numbers you wish to add? in writing the answer? Show what you mean.

5. When do you have to carry in addition? Show how.

6. How many ways to check an addition can you discover?

7. What do you have to be careful about in writing money numbers (dollars and cents) you wish to add? in writing the answer? Show what you mean.

8. If you do not remember the answers to these additions, how can you find them?

$9 + 7$ $6 + 8$ $8 + 9$ $8 + 5$

9. Why is it better to *know* the basic addition facts than to have to *find* them over and over?

Test yourself on the addition facts on page 305 to see if there are any you need to study.

Thinking about addition

Tom made a radio. He spent \$.80 for tubes, \$1.65 for batteries, and \$2.20 for other parts. How much did the radio cost all together?

To solve this problem, you *add*. The numbers you add are the ***addends***. The answer is the ***sum***. In this example read the addends; read the sum.

$$\begin{array}{rl} \left.\begin{array}{r} \$\ \ .80 \\ 1.65 \\ 2.20 \end{array}\right\} & \textbf{addends} \\ \hline \$4.65 & \textbf{sum} \end{array}$$

1. To add 18 and 7, Mary thought, "18 and 2 more are 20, and 5 more are _?_."

2. To add 36 and 9, Mary thought, "36 and 4 more are 40, and 5 more are _?_."

How would Mary "think out" these sums?

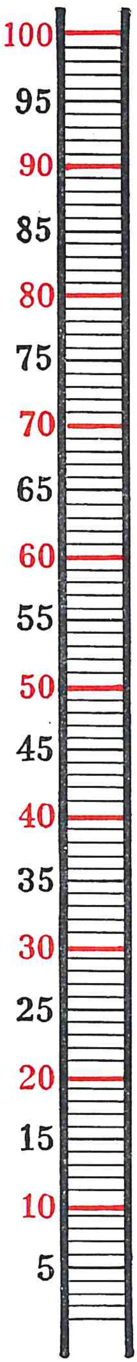
	a	*b*	*c*	*d*	*e*
3.	16 + 7	18 + 8	15 + 8	12 + 8	28 + 9
4.	18 + 6	28 + 4	27 + 7	16 + 5	35 + 3
5.	74 + 8	49 + 6	27 + 4	49 + 8	48 + 7
6.	36 + 7	24 + 6	48 + 5	37 + 2	49 + 5
7.	49 + 3	39 + 7	37 + 8	54 + 7	28 + 3
8.	54 + 5	48 + 4	49 + 2	56 + 5	49 + 4
9.	62 + 6	44 + 7	57 + 4	38 + 9	45 + 5

Mary made a discovery when she did each of these groups of additions. What was her discovery? What is the "key fact" in each group?

10. $\left\{\begin{array}{r} 3+5 \\ 13+5 \\ 23+5 \\ 43+5 \end{array}\right.$ **11.** $\left\{\begin{array}{r} 4+5 \\ 14+5 \\ 24+5 \\ 84+5 \end{array}\right.$ **12.** $\left\{\begin{array}{r} 9+5 \\ 19+5 \\ 29+5 \\ 79+5 \end{array}\right.$ **13.** $\left\{\begin{array}{r} 8+6 \\ 18+6 \\ 28+6 \\ 48+6 \end{array}\right.$ **14.** $\left\{\begin{array}{r} 7+6 \\ 17+6 \\ 27+6 \\ 67+6 \end{array}\right.$

15. Tell the sums in Exs. 3–9 above, using Mary's discovery. Say, "6 + 7 = 13, so 16 + 7 = 23"; and so on.

Using your head in adding



1. When Jane adds 10 and 14, she imagines that she is climbing up a number ladder. She starts at 10 and goes up 10 more; that brings her to 20. Then she goes up 4 more, which brings her to 24. So $10 + 14 = \underline{\ ?\ }$.

2. When Jane adds 20 and 16, she thinks, "20 and 10 are 30, and 6 more are $\underline{\ ?\ }$. So $20 + 16 = \underline{\ ?\ }$."

3. To add 25 and 13, Jane thinks, "25 and 10 are $\underline{\ ?\ }$, and 3 more are $\underline{\ ?\ }$. So $25 + 13 = \underline{\ ?\ }$."

Use Jane's number ladder to do these additions:

	a	*b*	*c*	*d*
4.	$40 + 20$	$40 + 23$	$42 + 23$	$45 + 25$
5.	$50 + 30$	$50 + 34$	$51 + 32$	$54 + 36$
6.	$60 + 40$	$60 + 33$	$52 + 43$	$65 + 35$
7.	$80 + 20$	$80 + 14$	$81 + 12$	$81 + 19$

8. Jane says there is more than one good way to add mentally. She can add 27 and 15 two ways:

First way: $27 + 15 = 27 + 10 + 5 = \underline{\ ?\ }$
Second way: $27 + 15 = 20 + 10 + 7 + 5 = \underline{\ ?\ }$

Which way do you like better? Think of other quick ways to add 27 and 15 mentally.

Use an easy way to do these additions in your head:

9.	$27 + 13$	$78 + 12$	$18 + 13$	$37 + 24$
10.	$38 + 14$	$88 + 14$	$19 + 16$	$49 + 32$
11.	$56 + 15$	$98 + 15$	$17 + 18$	$58 + 25$
12.	$64 + 17$	$69 + 16$	$27 + 14$	$88 + 23$
13.	$120 + 34$	$120 + 48$	$120 + 57$	$120 + 85$
14.	$140 + 27$	$140 + 38$	$140 + 61$	$140 + 76$

Estimating sums in addition

1. George is *estimating* to see if his answers at the right are sensible.

In the first example, he thinks, "78 is almost 80; 42 is close to 40; 56 is near 60. So I estimate that the answer will be close to 80 + 40 + 60, or 180."

Is his answer of 176 sensible?

2. Check George's other answers by estimating. One answer is not sensible. Which one is it? How did you estimate it? What is the correct answer to that addition?

GEORGE

78	38	76
42	51	42
56	40	59
176	129	177
23	49	30
57	82	28
60	78	59
140	209	137

3. To estimate the first sum in his additions at the right, Tom thinks,

"$159.60 is closer to $200 than to $100.
"$215.00 is a little over $200.
"$320.00 is closer to $300 than to $400."

Is Tom's answer of $695.48 sensible?

4. Estimate to see if Tom's other answers are sensible.

TOM

$159.60	386
215.70	515
320.18	509
$695.48	1610
	$7.75
$540.75	4.35
375.78	5.05
628.15	2.91
$1544.68	$20.06

5. Look at the work at the right and see how Diana estimated that sum.

Why did she think of 878 as 1 thousand? of 46 as 0 thousand? of 2954 as 3 thousand?

Diana estimated the sum to be ___?___ thousand. Does her estimate show that 10,190 is a sensible answer?

DIANA

Exact sum		Estimated sum
6305	→	6 thousand
878	→	1 thousand
46	→	0 thousand
7	→	0 thousand
2954	→	3 thousand
10,190		10 thousand

6. Paul and Diana did this addition:

1,246 + 954 + 3,942 + 35

Paul's answer is 6,177. Diana's answer is 5,177. By estimating tell whose answer is wrong.

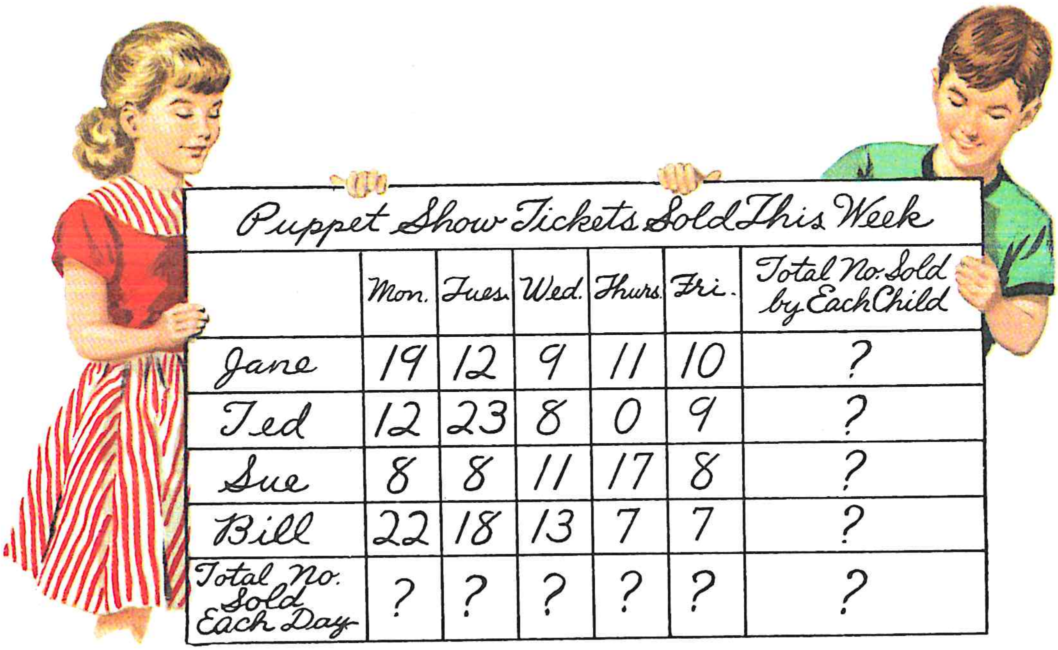
Using addition

Find the answers. Then estimate each answer to be sure it is sensible.

1. George paid $10.00 for a second-hand bicycle. He paid $4.75 for a new tire and $2.10 to have the brakes fixed. In all he spent _?_.

2. Find the total cost of this food for a picnic:

Rolls	$.48	Hot dogs	$.73
Apples	$.54	Soft drinks	$.50
Cookies	$.39	Marshmallows	$.32



Puppet Show Tickets Sold This Week

	Mon.	Tues.	Wed.	Thurs.	Fri.	Total No. Sold by Each Child
Jane	19	12	9	11	10	?
Ted	12	23	8	0	9	?
Sue	8	8	11	17	8	?
Bill	22	18	13	7	7	?
Total No. Sold Each Day	?	?	?	?	?	?

Miss Green's class is giving a puppet show. The members of the ticket committee made the above chart to show how many tickets each member sold during the week.

3. How many tickets were sold on Monday? on each of the other days? Where should this be shown on the chart?

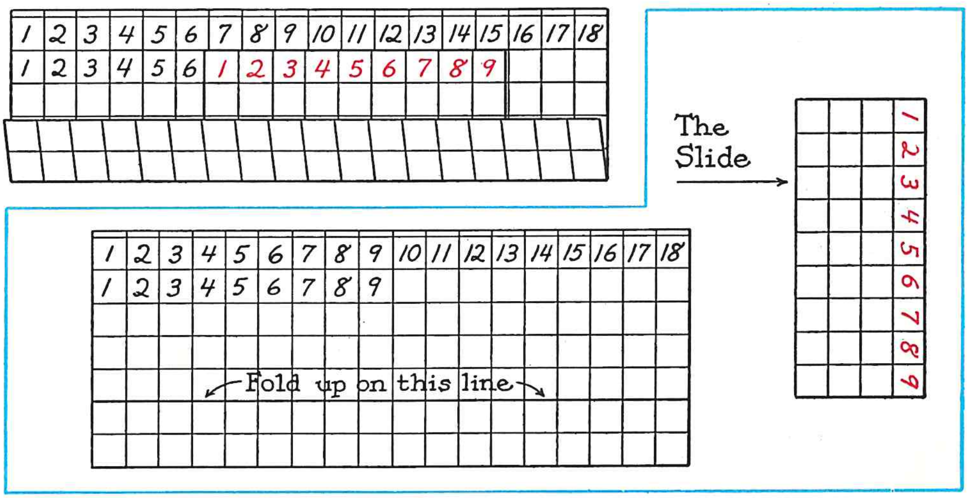
4. How many tickets were sold by Jane? by each of the other children? Where should this be shown on the chart?

5. Now write down two different additions to find how many tickets were sold all together this week. Should the sums of these two additions be the same? Why?

Thinking about addition

Joe made this slide rule to help him learn addition facts. Make one for yourself. The slip with the red figures on it slides back and forth.

The way the slide rule is set now shows that 6 (black) and 1 (red) are 7. Where do you see the 7? What other addition facts does it show?



1. Move your slide rule to show all the facts with sums of 8; 10; 12; 15.

2. Find: $7 + 7$ $7 + 8$ $7 + 6$ $8 + 8$ $8 + 9$ $8 + 7$.

3. Make all the discoveries you can with your slide rule.

4. Joe did not know the answer to $9 + 8$. He used these six ways to learn it:

- $10 + 8 = 18$; so $9 + 8 = \underline{\ ?\ }$.
- $9 + 9 = 18$; so $9 + 8 = \underline{\ ?\ }$.
- $8 + 8 = 16$; so $9 + 8 = \underline{\ ?\ }$.
- He wrote the number family:

  $8 + 9 = \underline{\ ?\ }$ $\quad 17 - 8 = \underline{\ ?\ }$

  $9 + 8 = \underline{\ ?\ }$ $\quad 17 - 9 = \underline{\ ?\ }$
- He found $9 + 8$ on his slide rule. You can find it, too.
- Joe then wrote $9 + 8 = 17$ ten times.

5. Take the test on page 305.

- Make a list of all the facts that were hard for you, that you did not know, or that were wrong.
- Find the answer to each fact on your list in as many different ways as you can. (See how Joe learned $9 + 8 = 17$ in Ex. 4.)
- Practice your list of addition facts until you are **sure** you know every one.

Keep your slide rule, you will need it on page 21.

Working for speed and accuracy

These tests will help you find out how well you add. Do not copy the examples. Use folded paper. Add **down**. *Check each answer by adding* ***up*** *to see if you get the same answer.*

If you make more than one error in Test I, do Practice Set I on the next page. Do the same for Tests II, III, IV, and V.

▶ ADDITION TEST I

1.	**2.**	**3.**	**4.**	**5.**	**6.**
48	40	86	95	72	78
31	56	33	42	93	30

▶ ADDITION TEST II

1.	**2.**	**3.**	**4.**	**5.**	**6.**
72	82	66	48	78	59
78	89	89	62	65	58

▶ ADDITION TEST III

1.	**2.**	**3.**	**4.**	**5.**	**6.**
73	73	54	85	4	36
20	21	67	3	66	67
36	45	89	67	95	20

▶ ADDITION TEST IV

1.	**2.**	**3.**	**4.**	**5.**
384	577	27	3256	900
86	30	6350	60	8352
5	842	287	697	976
479	586	4983	9854	8394

▶ ADDITION TEST V

Remember the dollar sign and cents point in each answer.

1.	**2.**	**3.**	**4.**
$1.53	$5.98	$279.00	$248.65
4.98	.46	2.00	2.98
6.07	2.97	564.75	413.53
5.39	.08	.82	5.48
.20	6.35	46.73	102.76

Working for speed and accuracy

If you made any mistakes in Addition Test I on page 14, do Practice Set I below. Use folded paper for these examples. Add down. Check each answer. Then take Addition Test I on page 14 again; and so on.

▶ PRACTICE SET I

1.	2.	3.	4.	5.	6.
26	75	40	68	74	64
33	53	45	20	35	43

▶ PRACTICE SET II

1.	2.	3.	4.	5.	6.
34	78	88	38	67	49
68	62	43	75	24	23

▶ PRACTICE SET III

1.	2.	3.	4.	5.	6.
50	35	35	55	21	57
37	12	50	94	69	78
82	62	6	52	35	60

▶ PRACTICE SET IV

1.	2.	3.	4.	5.
571	20	35	1761	259
5	405	2493	208	5048
672	47	964	74	543
433	879	3606	9544	1380

▶ PRACTICE SET V

Don't forget to put the dollar sign and cents point in each answer.

1.	2.	3.	4.
\$2.55	\$2.08	\$ .32	\$ 45.42
3.33	7.37	14.56	8.65
5.23	.64	1.86	320.20
9.08	9.16	223.01	430.58
.80	.88	5.47	2.00

Addition practice

Do not copy these examples; use folded paper. Add down. Check each example by adding up to see if you get the same answer.

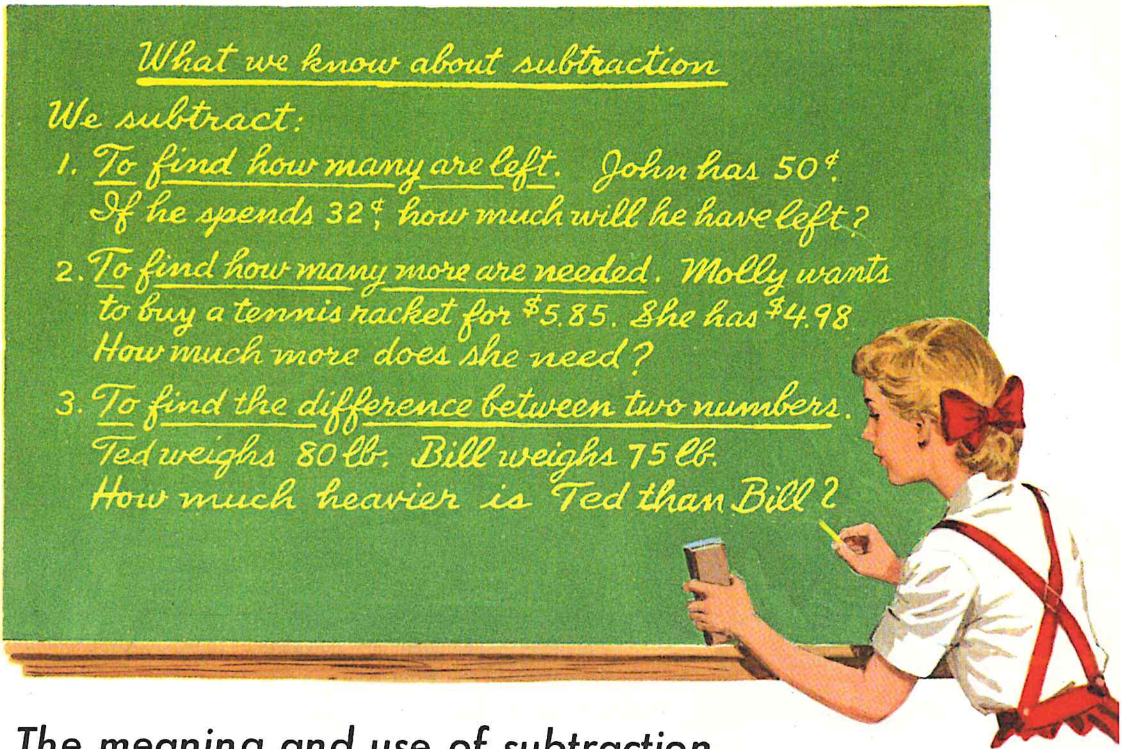
	a	b	c	d	e	f	g
1.	85 52	26 83	59 94	87 58	79 78	48 71	76 68
2.	44 35 70	52 35 72	8 66 60	74 8 72	43 60 86	39 76 97	78 96 58
3.	22 38 55 96 87 54	35 87 38 54 76 48	16 89 35 86 74 98	18 78 40 85 70 69	24 77 65 90 87 74	53 98 20 75 63 87	83 92 54 83 76 98

There are 7 **mistakes** *in the next examples. See how long it takes you to find them all.*

	a	b	c	d	e
4.	89 635 89 475 1088	89 375 804 69 1337	80 93 854 679 1716	805 900 876 549 3030	600 1754 683 3859 6897
5.	\$ 9.80 5.07 8.95 7.54 \$31.36	\$5.00 8.75 6.73 5.89 \$26.27	\$3.29 8.76 5.94 8.73 \$26.72	\$2.46 8.73 7.69 5.08 \$22.96	\$7.65 33.98 9.73 25.84 77.20

Meaning and use of subtraction
Subtracting mentally
Estimating differences. Practice for speed and accuracy

UNIT
3



The meaning and use of subtraction

1. Look at the picture. What kinds of questions can Miss Green's class answer by subtraction?

2. Tell about the needs your class has for subtracting.

3. What does subtracting mean?

4. What do you have to be careful about in writing down a subtraction such as this?

$$\begin{array}{r} 978 \\ -\ 569 \\ \hline \end{array}$$

5. When do you have to borrow in subtraction? Illustrate.

6. Do the subtraction in Ex. 4. Can you show two ways to check the answer?

7. If you do not remember these answers, how can you find them? $15 - 9$ $\quad 13 - 6$

8. What subtraction facts does this addition teach? $7 + 6 = 13$

9. Why is it better to *know* the subtraction facts than to have to *find* them over and over?

10. Take the test on page 306.

Thinking about subtraction

In September Jerry had \$7.98 in the school bank. Now he has \$10.25. How much has he put in this year?

\$10.25	**minuend**
− 7.98	**subtrahend**
\$ 2.27	**difference**
\$10.25	**check**

To solve this problem, you *subtract.* \$10.25 is the ***minuend.*** \$7.98 is the ***subtrahend.*** The answer is the ***difference*** or ***remainder.***

1. Explain how the subtraction is checked. Can you think of another way to check it?

2. Must the subtrahend be smaller than the minuend?

3. Can the difference be larger than the minuend? than the subtrahend? Give some illustrations to prove your answers.

4. I am thinking of a subtraction example. The minuend is 50. The subtrahend is 38. What is the difference or remainder?

5. 10 − 3 = ___?___   20 − 3 = ___?___
30 − 3 = ___?___   40 − 3 = ___?___

6. When Bob wants to find 32 − 5, he first subtracts 2 from 32. Then he subtracts ___?___ from 30.

Tell how Bob could "think out" these subtractions:

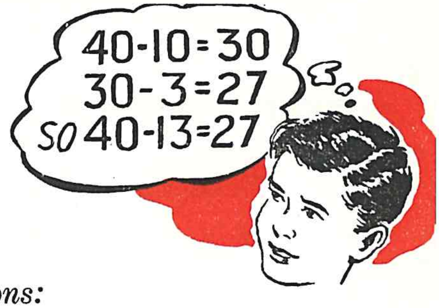
	a	*b*	*c*	*d*	*e*
7.	23 − 5	32 − 4	44 − 5	56 − 7	68 − 3
8.	31 − 4	42 − 5	53 − 6	67 − 4	74 − 5
9.	64 − 6	75 − 8	84 − 5	92 − 7	81 − 8
10.	62 − 5	78 − 9	87 − 9	96 − 7	52 − 9

Bob made a discovery when he did these subtractions. What was it? What is the "key fact" in each group?

11.	12.	13.	14.	15.
9 − 5	16 − 7	13 − 5	15 − 8	17 − 9
19 − 5	26 − 7	23 − 5	25 − 8	27 − 9
29 − 5	36 − 7	73 − 5	45 − 8	77 − 9
39 − 5	96 − 7	93 − 5	95 − 8	97 − 9

16. Do Exs. 7–10 again, using Bob's discovery. For the first example, 23 − 5, say, "13 − 5 is 8, so 23 − 5 is 18."

Using your head in subtracting



Tom uses his head when he subtracts. To subtract 13 from 40, he thinks: →

Use Tom's method to do these subtractions:

	a	b	c	d	e
1.	50 − 16	70 − 18	90 − 15	40 − 17	50 − 13
2.	60 − 12	80 − 13	70 − 11	30 − 19	80 − 19

3. To subtract 24 from 51, Tom thinks:
"51 − 20 = 31; 31 − 4 = 27; so 51 − 24 = ___?___."

Tell what you think as you do these subtractions:

	a	b	c	d	e
4.	45 − 12	96 − 12	31 − 12	33 − 14	89 − 15
5.	57 − 13	97 − 14	42 − 14	44 − 15	69 − 18
6.	68 − 14	88 − 17	53 − 15	92 − 16	64 − 15
7.	120 − 50	120 − 51	120 − 52	120 − 53	120 − 57
8.	138 − 60	138 − 62	149 − 75	168 − 83	157 − 63

Choose the correct answer to each of these subtractions. Begin: 91 is about 90; 19 is about 20; 90 − 20 = 70. The answer should be about 70; so 72 must be the correct answer.

9. Does 91 − 19 = 82, 72, or 62?
10. Does 102 − 38 = 74, 84, or 64?
11. Does 149 − 81 = 78, 68, or 58?
12. Does 171 − 98 = 83, 73, or 63?
13. Does 132 − 51 = 71, 61, or 81?
14. Does 140 − 49 = 81, 91, or 71?
15. Does 189 − 81 = 98, 118, or 108?
16. Does 162 − 49 = 103, 113, or 123?
17. Does 151 − 19 = 142, 132, or 122?
18. Does 178 − 41 = 137, 127, or 147?
19. Does 239 − 28 = 201, 211, or 221?
20. Does 221 − 49 = 182, 172, or 162?

Practice in understanding

Do these examples orally:

1. $9 + 8 = \underline{\ ?\ }$.
2. $17 - 8 = \underline{\ ?\ }$.
3. Take 13 from 30.
4. $14 - \underline{\ ?\ } = 7$.
5. 15 less 8 is ___?___.
6. 9 added to 7 is ___?___.
7. 5 from 14 leaves ___?___.
8. $27 + \underline{\ ?\ } = 30$.
9. 9 more than 7 is ___?___.
10. 7 is 7 less than ___?___.
11. 6 more than 7 is ___?___.
12. $13 - 9$ equals ___?___.
13. 8 and 5 are ___?___.
14. 9 is 3 ___?___ than 6.
15. 6 is 9 ___?___ than 15.

16. The number that is 5 larger than 9 is ___?___.

17. The difference between 13 and 4 is ___?___.

18. The total of 7, 9, 8 is ___?___.

19. When 8 is subtracted from 15, the remainder is ___?___.

20. The sum of two addends is 10. One addend is 6, and the other is ___?___.

21. If you know that $34 - 18$ is 16, then you know that $16 + 18$ is ___?___.

22. If one of two addends is zero, the other addend and the sum are the ___?___.

23. If the subtrahend is zero, the remainder is equal to the ___?___.

24. The difference between \$7.00 and \$2.97 is about \$___?___.

25. In estimating the answer to \$100.00 – \$39.47, you would think, "\$100 – \$40 = \$___?___."

26. In estimating the difference between \$119.68 and \$80.29, you think, "120 dollars minus ___?___ dollars = ___?___ dollars."

27. Tom has saved \$7.85. He wants to buy a 35-dollar bicycle. In estimating the number of dollars still needed, Tom thinks, "\$35 – \$___?___ = \$___?___."

28. Marie has \$19.85. Estimate how much she will have left if she spends \$14.25 for a puppy.

29. Estimate how much you would have to put with \$34.12 to make \$64.95.

30. Estimate the difference between \$200.00 and \$139.84. Is the difference about \$70, about \$60, or about \$50?

Thinking about subtraction

1. Today you will need the slide rule you made for page 13. Use it to find:

$12 - 5$	$12 - 6$	$12 - 7$
$13 - 8$	$14 - 9$	$9 - 6$

2. When you use the slide rule to add, does the top row of numbers show the sum?

When you use the slide rule to subtract, what does the top row of numbers show? the red numbers? the black numbers on the lower row?

3. Use your slide rule to find:

- how many subtraction facts have a minuend of 10.
- how many subtraction facts have a remainder of 8.

4. Are the remainders even or odd numbers when you subtract:

- odd numbers from even numbers?
- even numbers from odd?
- even numbers from even?
- odd numbers from odd?

5. Is there a subtraction fact with:

- minuend 12, subtrahend 5?
- minuend 5, subtrahend 12?
- subtrahend 6, remainder 4?
- minuend 6, remainder 13?

6. Tim did not know the answer to $13 - 6$. He used these six ways to learn it:

- $12 - 6 = 6$; so $13 - 6 = \underline{\ ?\ }$.
- $10 - 6 = 4$; so $13 - 6 = \underline{\ ?\ }$.
- $14 - 6 = 8$; so $13 - 6 = \underline{\ ?\ }$.
- He wrote the number family:

$7 + 6 = \underline{\ ?\ }$	$13 - 7 = \underline{\ ?\ }$
$6 + 7 = \underline{\ ?\ }$	$13 - 6 = \underline{\ ?\ }$

- He found $13 - 6$ on his slide rule. You find it, too.
- Finally, Tim wrote $13 - 6 = 7$ ten times.

7. Take the test on subtraction facts on page 306.

- Make a list of all the facts you need to learn.
- Find the answer to each fact on your list in as many ways as you can. (See how Tim learned that $13 - 6 = 7$ in Ex. 6.)
- Practice your list of subtraction facts until you are **sure** you know them.

Would your class like to give your slide rules to a third-grade class in your school? You could teach the children how to use them, and explain why they show the right answers.

Working for speed and accuracy

Here are five tests to help you find out how well you subtract. Check each answer by adding the remainder and subtrahend to see if their sum equals the minuend.

If you make more than one error in Test I, do Practice Set I on the next page; and so on.

For Tests I to IV, write your answers on folded paper.

Subtraction Test I

1. 69	2. 86	3. 127	4. 175	5. 147	6. 135
54	23	84	95	80	93

Subtraction Test II

1. 75	2. 60	3. 84	4. 111	5. 153	6. 140
47	51	55	35	94	63

Subtraction Test III

1. 141	2. 513	3. 920	4. 606	5. 1540	6. 921
97	428	766	348	875	196

Subtraction Test IV

1. 400	2. 6000	3. 6005	4. 35704	5. 49876
297	3476	458	27631	4325

Subtraction Test V

Copy and subtract. Don't forget the dollar sign and the cents point.

1. \$29.76	2. \$546.08	3. \$100.00	4. \$364.07	5. \$745.98
13.72	139.89	54.28	290.08	501.09

6. From \$5 take \$1.98; take \$3.75; take \$2.89; take \$.75.

7. From \$10 take \$9.45; take \$9.95; take \$3.05; take \$.10.

Working for speed and accuracy

If you made any mistakes in Test I on page 22, do Practice Set I below. Use folded paper for these exercises.

Subtract and check your work. Then take Test I on page 22 again; and so on.

Practice Set I

1. 57	**2.** 96	**3.** 108	**4.** 117	**5.** 106	**6.** 126
35	45	55	84	76	90

Practice Set II

1. 94	**2.** 95	**3.** 160	**4.** 121	**5.** 153	**6.** 190
78	57	76	73	95	98

Practice Set III

1. 175	**2.** 611	**3.** 674	**4.** 901	**5.** 3367	**6.** 1603
98	559	386	806	768	938

Practice Set IV

1. 600	**2.** 5000	**3.** 18008	**4.** 53041	**5.** 32085
311	902	1889	9986	5305

Practice Set V

Copy and subtract. Don't forget the dollar sign and the cents point.

1. \$48.75	**2.** \$708.06	**3.** \$400.00	**4.** \$655.15	**5.** \$701.99
10.93	308.57	75.46	280.08	551.98

6. From \$6 take \$.79; take \$2.97; take \$.29; take \$4.56.

7. From \$10 take \$.52; take \$6.48; take \$1.01; take \$5.20.

A KEEN LAD
IS ROGER REX;
WHEN HE SUBTRACTS
HE ALWAYS CHECKS!

Subtraction practice

Subtract. Write the answers on folded paper. Check.

	a	b	c	d	e	f
1.	88	67	149	137	109	118
	48	35	62	54	45	72
2.	32	80	94	168	122	174
	7	16	35	65	87	78
3.	151	612	933	1260	590	1622
	79	123	644	578	101	348
4.	1108	800	965	7003	5000	36876
	396	237	896	616	4708	9890

Subtract and check. Be sure to place the dollar sign and the cents point in each answer.

	a	b	c	d	e
5.	\$149.25	\$459.85	\$986.12	\$800.00	\$765.75
	83.75	94.68	475.58	509.23	387.77

6. From \$2 take \$.85

7. From \$8 take \$1.89

8. From \$12 take \$7.98

9. From \$15 take \$10.00

10. From \$20 take \$12.05

11. From \$30 take \$7.49

Using addition and subtraction

First tell whether you add or subtract to find each answer. Next solve each problem and check the answer. Then estimate to see if the answer is sensible.

1. Joe has $13. He spends $4.98 for a pair of skates.
How much will he have left?

2. Nancy wants to buy a phonograph record for $.75, and a package of needles for $.49.
How much does she need?

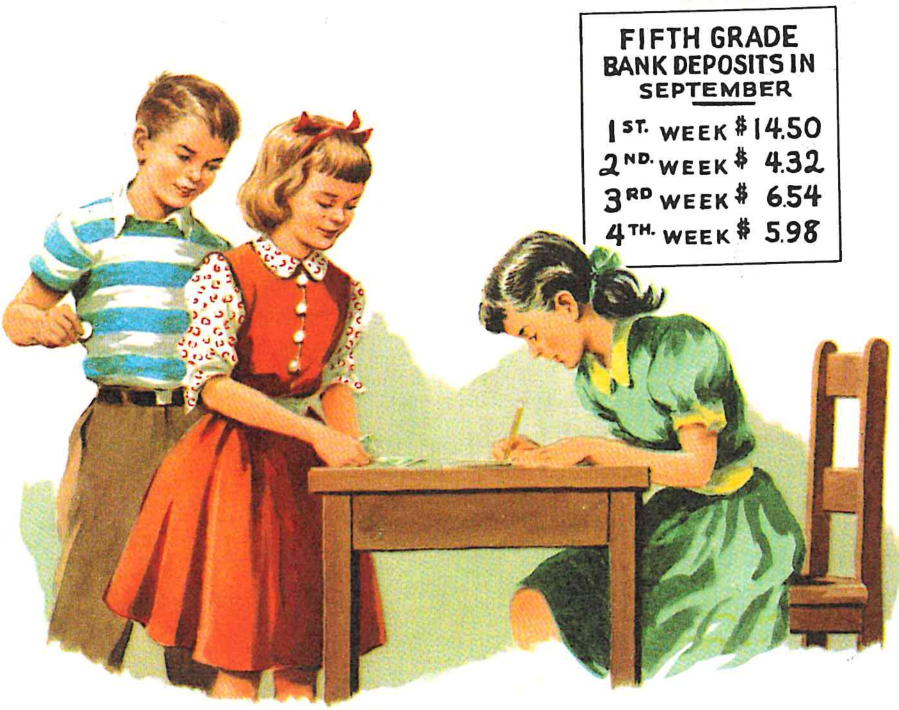
3. Allan weighed 69 lb. a year ago. Now he weighs 77 lb.
He has gained _?_ lb.

4. There are 34 pupils in the fifth grade. Only 29 are present today. How many are absent?

5. The Elmwood school bus holds 36 pupils.
Is it large enough to carry 16 pupils from the fifth grade and 19 pupils from the sixth grade who want to go to the museum?

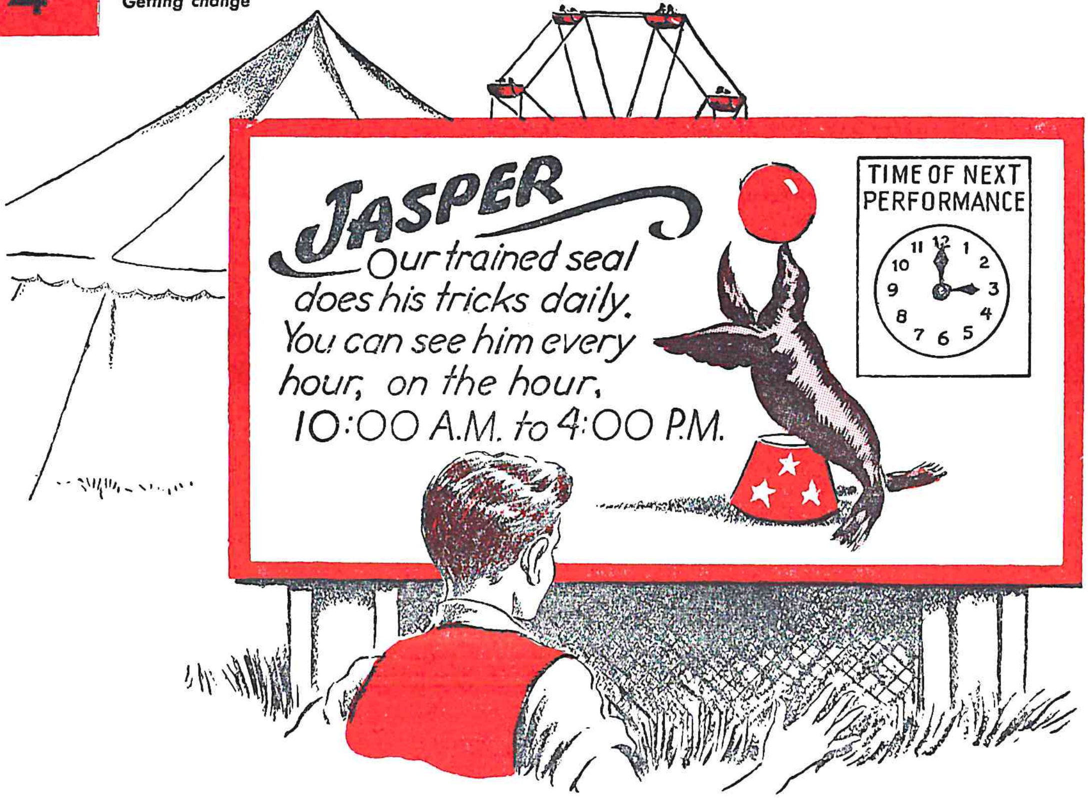
6. Tom wants to buy a muskrat trap for 60¢. He has 29¢.
How much more does he need?

7. Ann says the fifth-grade pupils put $31.34 in the school bank in September.
Look at the picture. Do you agree with Ann?



UNIT 4

Using arithmetic
Reading time
Roman numerals
Getting change



Time problems

1. Roy saw this sign at Playland Park. He looked at his watch. The time was twenty minutes after two.

Roy said, "I'll come back in __?__ minutes to see Jasper do his tricks."

2. The Model Airplane Club meets at 4:15 P.M. on Fridays. It takes Ted 25 minutes to go on his bike from his home to the clubroom.

At what time should Ted leave home to arrive at the club meeting on time?

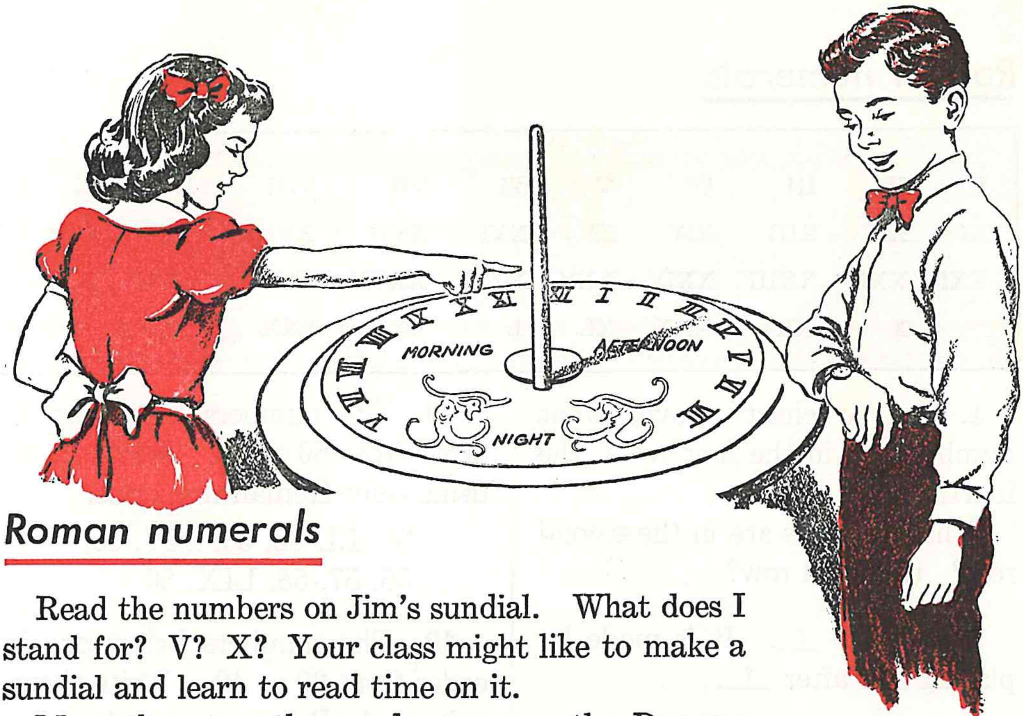
3. Bill arrived at the Airplane Club meeting (See Ex. 2) at 25 minutes of 5. He was __?__ minutes late.

4. Bring to class radio and television programs; also bring local train and bus schedules.

Tell the class about arithmetic problems you have had in using these programs and schedules.

5. How long is it:

- from 7:45 A.M. to 9:00 A.M.?
- from 6:00 A.M. to 7:00 P.M.?



Roman numerals

Read the numbers on Jim's sundial. What does I stand for? V? X? Your class might like to make a sundial and learn to read time on it.

More than two thousand years ago the Romans used the letters I, V, X, L (and others) to stand for numbers. They are called ***Roman numerals.***

About a thousand years later the Arabs first began to use the figures we use today: 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0. They are called ***Arabic numerals***.

Reading or writing Roman numerals is like working a puzzle.
Can you figure out how the puzzles below work?

1. If X is 10 and I is 1, why does XI equal 11?

2. If X is 10 and V is 5, why does XV equal 15?

3. If L is 50 and X is 10, why does LX equal 60?

4. If X is 10, why does XXX equal 30?

5. Why does VI equal 6?

6. Why does IX equal 9?

7. Why does IV equal 4?

8. Why does XL equal 40?

9. LXX stands for _?_.

10. People living long ago wrote numbers in different ways.

See if you can find out how the Egyptians and American Indians wrote numbers.

Roman numerals

I	II	III	IV	V	VI	VII	VIII	IX	X
XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX
XXI	XXII	XXIII	XXIV	XXV	XXVI	XXVII	XXVIII	XXIX	XXX
	X	XX	XXX	XL	L	LX	LXX	LXXX	

1. In the chart above, what numbers are in the first row? the fourth row?

What numbers are in the second row? the third row?

2. VIII = ___?___. It is made by placing ___?___ after ___?___.

3. XL = ___?___. It is made by placing ___?___ before ___?___.

4. LXX = ___?___. It is made by placing ___?___ after ___?___.

5. XIX = ___?___. It is made by placing ___?___ after ___?___.

6. Make up a rule to explain how numbers like 6, 12, 60, 23 are written in Roman numerals.

7. Make up a rule to explain how numbers like 4, 9, 40 are written in Roman numerals.

8. Read these numbers of chapters in a book:

I IV VII X XIV XVI
XVIII XXV XXIX XXX

9. The numbers below are in order from 50 to 60. Write them, using only Roman numerals.

50, LI, 52, 53, LIV, 55,
56, 57, 58, LIX, 60

10. The numbers below are in order from 30 to 40. Write them, using only Roman numerals.

30, 31, XXXII, 33, 34,
XXXV, 36, 37, 38, 39, XL

11. What is the sum of XII and XIII?

12. Using 5 matches, Bill wrote in Roman numerals the fraction $\frac{1}{4}$. Then, by moving 1 match, he changed the fraction to $\frac{2}{3}$. Can you do Bill's trick?

13. Using 4 matches, form in Roman numerals the fraction $\frac{1}{2}$. Then, by moving one match, change the fraction to a value of 2.

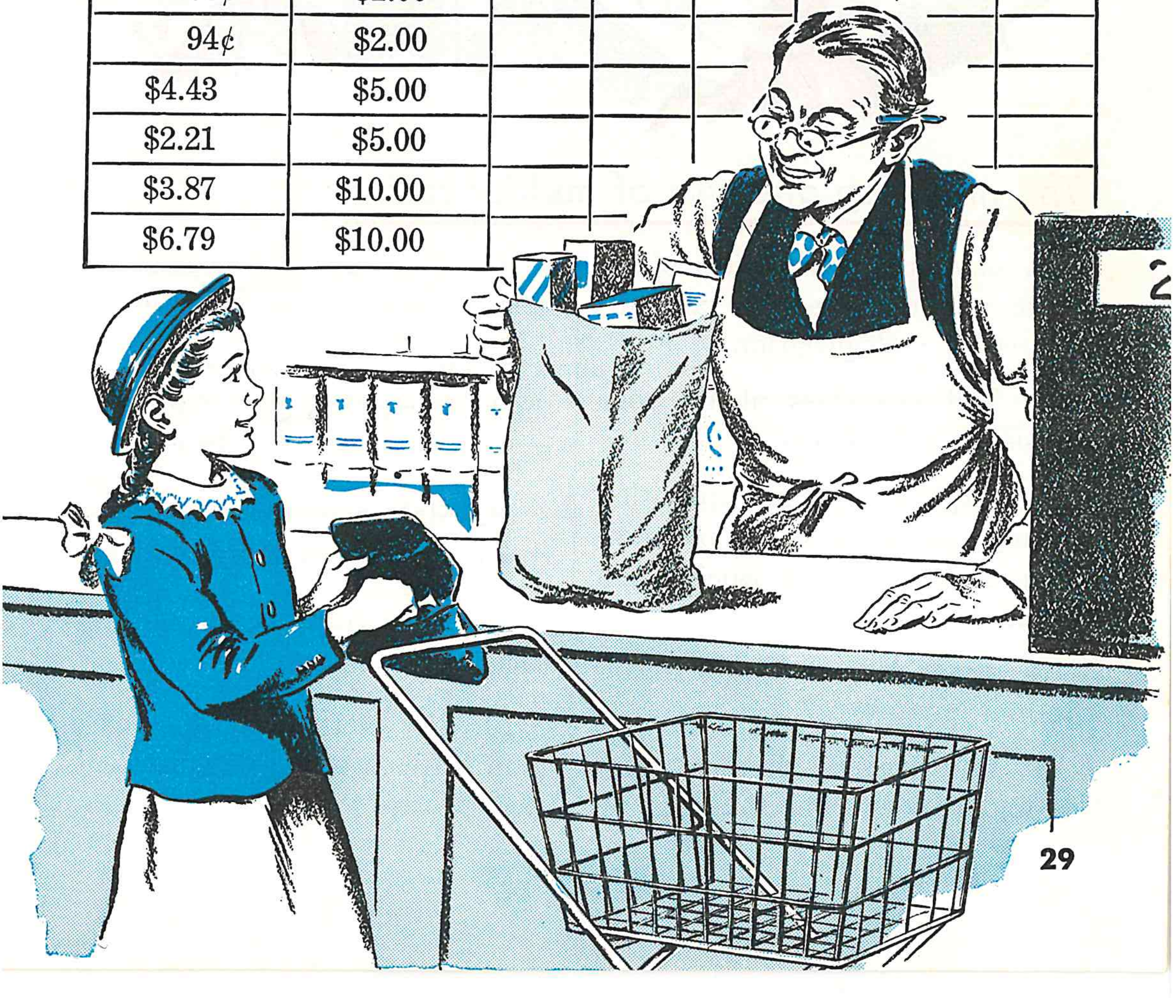
14. During this school year keep a list of places where you see Roman numerals.

Getting change

Alice often does the grocery shopping for her mother. She is always careful to see that she gets the correct change.

Tell what coins she should get in change on days when she spends these amounts. The first one is done for you.

AM'T SPENT	AM'T HANDED TO CLERK	CHANGE ALICE GETS BACK					
		Cents	Nickels	Dimes	Quarters	½ Dollars	Dollars
17¢	25¢	3	1				
36¢	50¢						
42¢	$1.00						
74¢	$1.00						
78¢	$1.00						
94¢	$2.00						
$4.43	$5.00						
$2.21	$5.00						
$3.87	$10.00						
$6.79	$10.00						



UNIT 5

Meaning and use of multiplication. Multiplying mentally. Estimating products. Practice for speed and accuracy

The meaning and use of multiplication

1. Give some illustrations of the kinds of questions that are answered by multiplication.

2. Tell the class about your needs for multiplying.

3. Explain: Any multiplication example could be solved by addition, but that would usually be a great waste of time.

4. What do you think it means to multiply 5 by 4?

5. Show several different ways to find 4 times 6 (4×6).

6. Why do you sometimes have to carry in multiplication?

7. Why is it better to *know* the basic multiplication facts than to *find* them over and over?

8. Make a dot drawing to show that 5 sixes are as many as 6 fives.

9. Take the test on multiplication facts on page 307.

10. Get pictures of egg boxes, muffin tins, etc. Tell what facts each picture shows.

Thinking about multiplication

1. Doris and Ellen sold 25 tickets for a school play. The tickets were \$.35 each. When the girls counted their money, they had \$8.75. Look at the multiplication in the box to see if \$8.75 is the amount the two girls should have had.

\$.35	multiplicand
× 25	multiplier
175	partial products
70	
\$8.75	product

2. In Ex. 1, which number is the ***multiplicand?*** the ***multiplier?*** the ***product?*** What are the ***partial products?***

3. Jane said that she could solve the problem in Ex. 1 by addition. In order to do so, Jane would have to use \$.35 as an addend _?_ times.

4. Jane said that the multiplier, 25, tells how many times the multiplicand, \$.35, is to be repeated. Was she right?

5. If Ex. 1 were solved by addition, would the sum of the 25 addends be the same as the product, \$8.75?

6. In the multiplication in Ex. 1, where is the 5×\$.35? the 20×\$.35?

7. The thinking in Ex. 1 is often stated: "If 1 ticket is worth \$.35, then 25 tickets are worth 25 times \$.35 (25 × \$.35), or _?_."

Multiplier times multiplicand equals product.

8. In the problem, "What is the cost of 5 notebooks at \$.24 each?" the multiplicand is _?_; the multiplier is _?_; the product is _?_.

Are there any partial products?

Tell the multiplier, multiplicand, and product in each of these:

9. What is the cost of 9 library books at \$2 each?

10. What is the cost of 2 library tables at \$64 each?

11. At 9 cents a pound, the cost of 6 pounds of sugar is _?_ cents.

12. If it takes 4 eggs to make one cake, how many eggs would you need for 3 cakes?

13. How many inches are there in 4 feet?

14. How many quarts are there in 5 gallons?

15. 8 × 7   9 × 5   6 × 8

16. 5 × 8   9 × 6   7 × 9

Thinking about multiplying

1. Mary finds 5×14 without writing down the example. She thinks, "$5 \times 4 = 20$; $5 \times 10 = 50$; $20 + 50 = \underline{\ ?\ }$."

Use Mary's method to find these products:

2.	8×15	8×35	8×64	4×62	5×76
3.	7×23	7×62	5×87	6×83	8×77

4. To find 3×123, Mary thinks $\left\{\begin{array}{l} 3 \times \quad 3 = \underline{\ ?\ } \\ 3 \times \ \ 20 = \underline{\ ?\ } \\ 3 \times 100 = \underline{\ ?\ } \end{array}\right.$ So $3 \times 123 = \underline{\ ?\ }$.

Use the method of Ex. 4 to do these multiplications:

	a	*b*	*c*	*d*	*e*
5.	3×126	4×132	5×213	9×218	6×219
6.	3×204	4×152	6×304	8×350	7×361
7.	3×415	4×165	7×212	7×201	8×418
8.	3×518	4×212	8×205	6×333	9×365

9. Explain the two multiplications in the box at the right. Now do Exs. 2 to 8 the way these multiplications are done.

$$\begin{array}{r} 64 \\ \times 9 \\ \hline 576 \end{array} \qquad \begin{array}{r} 147 \\ \times 3 \\ \hline 441 \end{array}$$

10. Study these multiplications:⟶
Make up a rule for multiplying a number by 10. Multiply these numbers by 10:

$$\begin{array}{l} 10 \times \quad 3 = 30 \\ 10 \times \ \ 12 = 120 \\ 10 \times 135 = 1350 \end{array}$$

7 16 55 82 90 105 250 287

11. John says that to multiply a number by 20, he multiplies first by 2 and then by 10. Explain.

12. Tell a short way to multiply a number by 30; by 40; by 50; by 100; 200; 300.

Multiply each of the numbers in Ex. 10 by 20; by 30; 40; 50; 100; 200; 300.

How many can you do without using a pencil?

Understanding multiplication

▶ To find 24×34, Bill thinks:

$$\begin{aligned} 4 \times 34 &= 136 \\ 20 \times 34 &= 680 \\ \hline \text{So } 24 \times 34 &= 816 \end{aligned}$$

▶ To find 35×21, he thinks:

$$\begin{aligned} 5 \times 21 &= 105 \\ 30 \times 21 &= 630 \\ \hline \text{So } 35 \times 21 &= 735 \end{aligned}$$

Tell what you think when you do these multiplications:

	a	*b*	*c*
1.	21×42	14×32	32×15
2.	22×42	33×38	12×33
3.	41×24	34×13	24×42

4. Bob and Dick each found 23×84. Look at their work.

How does Dick's work differ from Bob's?

Bob	Dick
84	84
×23	×23
252	252
1680	168
1932	1932

5. When Bob multiplies 84 by 23, his first partial product is 3×84, or 252. His second partial product is 20×84, or 1680.

The sum of the two partial products is __?__.

6. When Dick multiplies 84 by 23, does he first find $3 \times 84 = 252$?

For his second partial product Dick finds 20×84 this way: $2 \times 84 = 168$; $10 \times 168 = 1680$.

How does Dick's work show the 2×84? How does it show the 10×168?

Does he get the same answer as Bob?

Whose way do you like better?

7. Do Exs. 1–3, using Bob's method; then use Dick's method.

Copy and multiply. Check to see that each answer is sensible.

8.	$\begin{array}{r} 93 \\ \times\ 24 \\ \hline \end{array}$	$\begin{array}{r} 75 \\ \times\ 23 \\ \hline \end{array}$	$\begin{array}{r} 96 \\ \times\ 25 \\ \hline \end{array}$
9.	$\begin{array}{r} 98 \\ \times\ 12 \\ \hline \end{array}$	$\begin{array}{r} 97 \\ \times\ 34 \\ \hline \end{array}$	$\begin{array}{r} 86 \\ \times\ 54 \\ \hline \end{array}$

10. Do not use pencil and paper! Make up a multiplication table of 12's up to $12 \times 12 = 144$; a multiplication table of 11's up to $12 \times 11 = 132$.

Understanding multiplication

1. Jane and Roy found 267 × 304. Look at their work in the boxes.

Did Jane and Roy get the same answer?

2. When Jane multiplies 304 by 267, her first partial product is 7 × 304, or _?_. Her second partial product is 60 × 304, or _?_. Her third partial product is 200 × 304, or _?_.

3. Look at Roy's work. His first partial product is 7 × 304, or _?_. Compare his second partial product with Jane's. Compare their third partial products. Explain why Roy can write his second and third partial products as he does.

4. Most people prefer Roy's way of writing the multiplication. Can you tell why?

Jane

$$\begin{array}{r} 304 \\ \times\ 267 \\ \hline 2128 \\ 18240 \\ 60800 \\ \hline 81{,}168 \end{array}$$

Roy

$$\begin{array}{rrrrr} & & 3 & 0 & 4 \\ & \times & 2 & 6 & 7 \\ \hline & 2 & 1 & 2 & 8 \\ 1 & 8 & 2 & 4 & \\ 6 & 0 & 8 & & \\ \hline 8 & 1{,}1 & 6 & 8 & \end{array}$$

Do these multiplications by Roy's method. Then check your answer to each one by using Jane's method.

	a	*b*	*c*	*d*	*e*	*f*
5.	406 235	824 648	463 295	407 863	284 547	627 483
6.	904 328	624 315	738 256	482 351	563 284	187 375

7. How many partial products are there when you have a 2-place multiplier in an example? a 3-place multiplier?

8. In the boxes are 2 ways of finding 103 × 475. Explain the long way. Then figure out why the short way works.

Long Way

$$\begin{array}{rrrrr} & & 4 & 7 & 5 \\ & \times & 1 & 0 & 3 \\ \hline & 1 & 4 & 2 & 5 \\ 0 & 0 & 0 & & \\ 4\ 7 & 5 & & & \\ \hline 48{,}9 & 2 & 5 & & \end{array}$$

Short Way

$$\begin{array}{rrrrr} & & 4 & 7 & 5 \\ & \times & 1 & 0 & 3 \\ \hline & 1 & 4 & 2 & 5 \\ 4 & 7 & 5 & 0 & \\ \hline 48{,}9 & 2 & 5 & & \end{array}$$

9. $\begin{array}{r} 532 \\ \times\ 206 \\ \hline \end{array}$ $\quad$ $\begin{array}{r} 624 \\ \times\ 105 \\ \hline \end{array}$ $\quad$ $\begin{array}{r} 357 \\ \times\ 209 \\ \hline \end{array}$

Estimating products in multiplication

1. Betty wondered how many pupils there were in her school. She estimated this way: "There are 8 rooms with 38 pupils in a room. 38 is a little less than 4 tens. So the number of pupils is a little less than 8×4 tens, or 32 tens. I'll say about 300 as an estimate." How far off was her estimate?

2. Use Betty's method to estimate the cost of 8 games at 19 cents each; 7 books at 51 cents each.

Study these examples to see how the products are estimated. How far off is each estimate?

	EXAMPLE	ESTIMATED PRODUCT	EXACT PRODUCT
3.	$\begin{array}{r} 49 \\ \times 4 \\ \hline \end{array}$	$\begin{array}{l} \ 5 \text{ tens} \\ \times 4 \\ \hline \ 20 \text{ tens, or } 200 \end{array}$	$\begin{array}{r} 49 \\ \times 4 \\ \hline 196 \end{array}$
4.	$\begin{array}{r} 489 \\ \times 4 \\ \hline \end{array}$	$\begin{array}{l} \ 5 \text{ hundreds} \\ \times 4 \\ \hline \ 20 \text{ hundreds, or } 2000 \end{array}$	$\begin{array}{r} 489 \\ \times 4 \\ \hline 1956 \end{array}$
5.	$\begin{array}{r} 2056 \\ \times 6 \\ \hline \end{array}$	$\begin{array}{l} \ 2 \text{ thousands} \\ \times 6 \\ \hline \ 12 \text{ thousands, or } 12{,}000 \end{array}$	$\begin{array}{r} 2056 \\ \times 6 \\ \hline 12{,}336 \end{array}$

6. In estimating the answer to Ex. 3, the 49 was changed to 5 tens. In Ex. 4, the 489 was changed to _?_ hundreds. In Ex. 5, the 2056 was changed to _?_ thousands.

7. In estimating products, change:

   a 2-place number to the nearest number of tens;
   a 3-place number to the nearest number of hundreds;
   a 4-place number to the nearest number of _?_.

Estimate these products. Then find the exact products.

	a	*b*	*c*	*d*	*e*	*f*	*g*
8.	$\begin{array}{r} 84 \\ \times 6 \\ \hline \end{array}$	$\begin{array}{r} 113 \\ \times 7 \\ \hline \end{array}$	$\begin{array}{r} 87 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 209 \\ \times 9 \\ \hline \end{array}$	$\begin{array}{r} 1012 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} \$9.87 \\ \times 6 \\ \hline \end{array}$	$\begin{array}{r} \$40.36 \\ \times 4 \\ \hline \end{array}$

Practice in multiplication

Try to do these multiplications orally:

	a	b	c	d	e	f	g	h	i	j
1.	49	70	28	69	18	36	27	54	68	75
	2	8	3	6	7	5	4	9	4	6
2.	50	57	64	85	75	94	58	57	38	46
	4	7	7	8	5	4	3	6	9	8
3.	64	29	84	96	86	94	67	93	69	76
	8	9	6	4	6	5	8	7	7	9
4.	58	89	68	90	78	65	97	93	87	85
	7	8	5	9	4	9	6	8	5	6

Do these multiplication examples on paper:

	a	b	c	d	e	f
5.	16	58	69	84	56	36
	36	45	54	67	35	46
6.	76	50	76	80	83	99
	89	39	57	78	94	89
7.	867	809	888	750	806	463
	600	807	507	465	465	4000
8.	406	876	688	780	460	508
	605	708	465	76	98	609
9.	\$2.87	\$8.45	\$9.26	\$5.67	\$73.69	\$58.37
	68	95	67	86	9	7

10. Does $20 \times 3¢ = 3 \times 20¢$? Does $60 \times 3¢ = 3 \times 60¢$?

Earning — spending — saving

Amount Earned	
Delivered newspapers. I earned	$6.50
Cleaned Father's car. I earned	.75
Mowed Mrs. Best's lawn each week for 9 weeks. I got 45¢ a week	?
Took care of Mrs. Best's chickens for 3 weeks. I got $1.00 a week	?
Reward for finding lost dog	2.50
Total Amount Earned	?

Amount Spent	
Spent 45¢ a week for 12 weeks (bought ice cream, candy, pop, comics, etc.)	?
Spent on trips to beach and park	$3.70
Mother's birthday present	.59
Total Amount Spent	?

Amount Saved	
Amount saved to put in school bank	$2.50
Amount saved toward buying a sports jacket	4.61
Total Amount Saved	$7.11

Before school closed last June, Miss Blake asked her pupils to keep a record of the money they earned during their summer vacation. She also asked them to report how they spent their money and how much they saved.

1. Above is Harry's report of the money he earned, spent, and saved. Find the missing numbers.

2. Using the amounts Harry earned and spent, find how much he saved. Does that check with what he said he saved?

3. Do you earn money or do you have an allowance given you? What do you spend your money for?

Do you save part of your money? What things do you save it for?

Working for speed and accuracy

Here are some tests to help you find out how well you multiply. Use folded paper. Check each example by going over your work. If you make more than one error in Test I, do Practice Set I on the next page, and so on.

Multiplication Test I

1.	2.	3.	4.	5.	6.
76	89	79	87	69	87
5	4	6	9	8	6

Multiplication Test II

1.	2.	3.	4.	5.	6.
98	67	87	97	74	98
55	95	96	58	78	94

Multiplication Test III

1.	2.	3.	4.
\$5.79	\$4.85	\$4.86	\$67.57
93	97	57	8

5.	6.	7.	8.
\$8.66	\$3.58	\$6.79	\$75.79
69	68	84	6

Multiplication Test IV

1.	2.	3.	4.
679	225	302	730
843	274	126	172

5.	6.	7.	8.
211	245	526	869
305	941	202	254

Multiplication Test V

1.	2.	3.	4.	5.
865	509	427	730	432
700	673	205	754	6000

Working for speed and accuracy

If you made any mistakes in Test I on page 38, you need to do Practice Set I below. Use folded paper for these examples. Multiply, and check your work. Then take Test I on page 38 again; and so on.

▶ PRACTICE SET I

1.	2.	3.	4.	5.	6.
68	85	58	46	75	86
7	5	6	9	8	7

▶ PRACTICE SET II

1.	2.	3.	4.	5.	6.
48	69	45	77	54	88
27	56	46	57	47	98

▶ PRACTICE SET III

1.	2.	3.	4.
\$4.96	\$8.38	\$7.86	\$54.99
58	98	86	6

5.	6.	7.	8.
\$7.64	\$5.72	\$8.67	\$76.95
49	57	78	9

▶ PRACTICE SET IV

1.	2.	3.	4.
522	750	987	986
285	805	478	916

5.	6.	7.	8.
457	386	870	678
607	548	650	854

▶ PRACTICE SET V

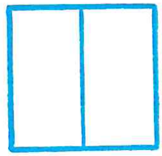
1.	2.	3.	4.	5.
596	608	570	908	468
800	705	456	708	7000

UNIT 6

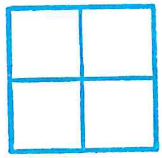
Meaning, interrelationships, and uses of halves, fourths, and eighths. Development of two basic meanings of a fraction

Halves — fourths — eighths

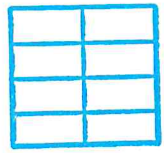
1. Ted wanted to divide a piece of sandpaper into 8 equal parts. First he cut it into 2 equal parts like this: →
Each of 2 equal parts is called *one half* ($\frac{1}{2}$).
How many halves are there in the whole piece?



2. Then he cut the paper crosswise like this: →
How many equal parts did he have? Each of 4 equal parts is called *one fourth*, or *one quarter* ($\frac{1}{4}$).
How many fourths are there in the whole piece?



3. He cut each fourth into 2 equal parts like this: →
Then he had _?_ equal parts. Each of 8 equal parts is called *one eighth* ($\frac{1}{8}$).
How many eighths are there in the whole piece?



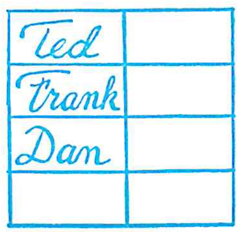
4. Ted, Frank, and Dan each took a piece of the sandpaper. How many eighths did they take in all? Three eighths is written: $\frac{3}{8}$.

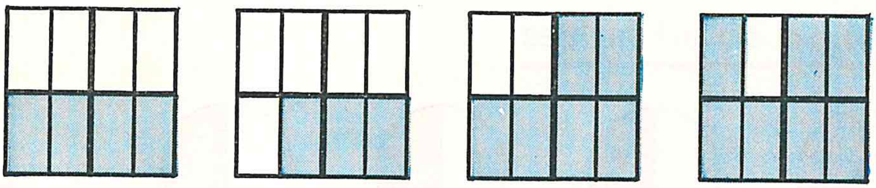
In the *fraction* $\frac{3}{8}$, the lower figure, 8, tells the number of equal parts into which the paper is divided. The name of each piece is an eighth.

The upper figure, 3, tells the number of parts the boys took.

5. How many eighths of the piece of sandpaper were left? Five eighths is written this way: $\frac{5}{8}$.

6. Look at the diagram at the right. Which fraction is larger, $\frac{1}{2}$ or $\frac{3}{8}$? $\frac{1}{2}$ or $\frac{5}{8}$?





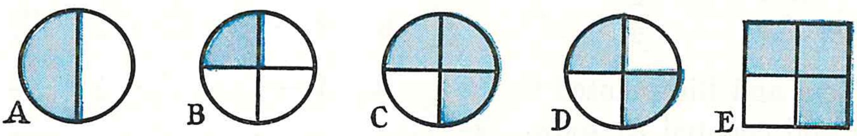
7. Jane says $\frac{1}{2}$ of the first square above is colored. Pete says $\frac{2}{4}$ of it is colored. Betty says $\frac{4}{8}$ of it is colored.

Show that each is right. Does $\frac{1}{2} = \frac{2}{4} = \frac{4}{8}$?

8. Tell what part of each of the other squares is colored.

9. Write as many fractions as you can that tell what part of each square is uncolored.

10. Write as many fractions as you can that tell what part of each of the figures below is colored; what part of each of the figures is uncolored.



11. Circle A above shows that $\frac{1}{2} + \frac{1}{2} = \frac{2}{2}$, or a whole. Circle B shows that $\frac{1}{4} + \frac{3}{4} = \frac{4}{4}$, or a whole.

What do figures C, D, and E show?

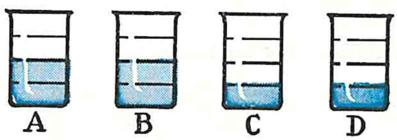
12. Jean baked an apple pie. If she serves $\frac{1}{4}$ of the pie, how many eighths will she serve?

If Jean serves $\frac{1}{2}$ of the pie, how many fourths will she serve? how many eighths?

$\frac{1}{4} = \frac{?}{8}$ $\qquad$ $\frac{1}{2} = \frac{?}{4}$ $\qquad$ $\frac{1}{2} = \frac{?}{8}$

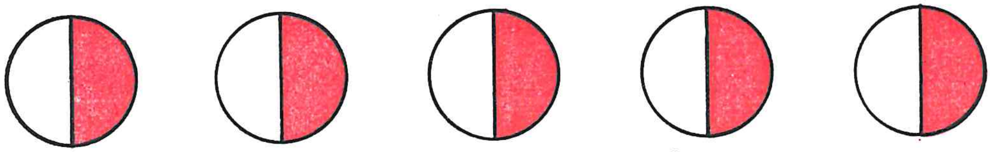
13. If you pour the water from Glass B into Glass A, do you show both of these facts?

$\frac{2}{2} = 1 \qquad \frac{1}{2} + \frac{1}{2} = 1$



14. What facts do you show if you pour the water from Glass D into Glass C? What facts do you show if you pour the water from Glass C into Glass B?

Learning about halves



1. What part of each of these circles is colored?

2. How many halves are there in 1 circle? in 2? 3? 4? 5?

3. $1 = \frac{2}{2}$ $\quad 2 = \frac{4}{2}$ $\quad 3 = \frac{?}{2}$ $\quad 4 = \frac{?}{2}$ $\quad 5 = \frac{?}{2}$

4. 3 halves = _1_ whole and 1 half.⟶ $\frac{3}{2} = 1\frac{1}{2}$
   4 halves = _?_ wholes.⟶ $\frac{4}{2} =$ _?_
   5 halves = _?_ wholes and 1 half.⟶ $\frac{5}{2} = 2\frac{1}{2}$
   6 halves = _?_ wholes.⟶ $\frac{6}{2} =$ _?_

5. The circles show that:

   $\frac{7}{2} =$ _?_ $\qquad \frac{9}{2} =$ _?_
   $\frac{8}{2} =$ _?_ $\qquad \frac{10}{2} =$ _?_

6. Tom and Bill pointed to the circles and counted as shown below. Tell the missing numbers.

   Tom said:

   $\frac{1}{2}$ $\frac{2}{2}$ $\frac{3}{2}$ $\frac{4}{2}$ $\frac{?}{2}$ $\frac{6}{2}$ $\frac{7}{2}$ $\frac{?}{2}$ $\frac{9}{2}$ $\frac{?}{2}$

   Bill said:

   $\frac{1}{2}$ 1 $1\frac{1}{2}$? $2\frac{1}{2}$? $3\frac{1}{2}$? $4\frac{1}{2}$ 5

7. Beginning at $4\frac{1}{2}$, count backward by halves.

Use the circles to help you do these examples:

8. $\frac{3}{2} + \frac{1}{2}$ $\qquad 2\frac{1}{2} + \frac{1}{2}$ $\qquad 2\frac{1}{2} + 1$

9. $1 - \frac{1}{2}$ $\qquad 2 - \frac{1}{2}$ $\qquad 2 - 1\frac{1}{2}$

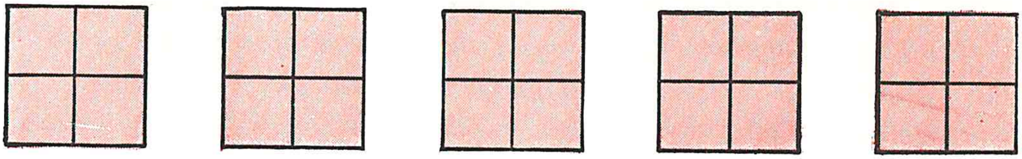
10. $2 \times \frac{1}{2}$ $\qquad 4 \times \frac{1}{2}$ $\qquad 2 \times 1\frac{1}{2}$

11. $2\frac{1}{2} + 1\frac{1}{2}$ $\qquad 4 - 2\frac{1}{2}$ $\qquad 2 \times 2\frac{1}{2}$

12. How many halves are there in 1? in 2? in $2\frac{1}{2}$? in $3\frac{1}{2}$?

13. Larry wants 3 lb. of salted peanuts. How many of these half-pound boxes should he buy?

Learning about fourths



1. In each of these squares there are $\underline{\ ?\ }$ fourths.

2. How many fourths are there in 1 square? in 2? 3? 4? 5?

3. 5 fourths = $\underline{\ 1\ }$ whole and $\underline{\ 1\ }$ fourth. $\longrightarrow \frac{5}{4} = 1\frac{1}{4}$
   6 fourths = $\underline{\ ?\ }$ whole and $\underline{\ ?\ }$ fourths. $\longrightarrow \frac{6}{4} = 1\frac{2}{4}$
   7 fourths = $\underline{\ ?\ }$ whole and $\underline{\ ?\ }$ fourths. $\longrightarrow \frac{7}{4} = \underline{\ ?\ }$
   8 fourths = $\underline{\ ?\ }$ wholes. $\longrightarrow \frac{8}{4} = \underline{\ ?\ }$

4. The squares show that:

$\frac{9}{4} = 2\frac{?}{4}$ $\quad \frac{10}{4} = 2\frac{?}{4}$ $\quad \frac{11}{4} = \underline{\ ?\ }$ $\quad \frac{12}{4} = \underline{\ ?\ }$ $\quad \frac{13}{4} = \underline{\ ?\ }$ $\quad \frac{14}{4} = \underline{\ ?\ }$

$\frac{15}{4} = \underline{\ ?\ }$ $\quad \frac{16}{4} = \underline{\ ?\ }$ $\quad \frac{17}{4} = \underline{\ ?\ }$ $\quad \frac{18}{4} = \underline{\ ?\ }$ $\quad \frac{19}{4} = \underline{\ ?\ }$ $\quad \frac{20}{4} = \underline{\ ?\ }$

5. Point to the squares and count them by fourths:

First Way:

$\frac{1}{4}, \frac{2}{4}, \frac{3}{4}, \frac{4}{4}, \frac{5}{4}, \frac{6}{4},$ and so on.

Second Way:

$\frac{1}{4}, \frac{1}{2}, \frac{3}{4}, 1, 1\frac{1}{4}, 1\frac{1}{2},$ and so on.

6. Begin at 3. Count backward by fourths.

How does this counting help you subtract $\frac{2}{4}$ from $2\frac{1}{4}$? $\frac{3}{4}$ from $1\frac{1}{2}$?

7.

$$\begin{array}{r} \text{1 fourth} \\ +\ \text{3 fourths} \\ \hline \end{array} \qquad \begin{array}{r} \text{9 fourths} \\ -\ \text{3 fourths} \\ \hline \end{array}$$

8.

$$\begin{array}{r} \text{2 fourths} \\ \times\ 3 \quad\quad \\ \hline \end{array} \qquad \begin{array}{r} \text{4 fourths} \\ \times\ 2 \quad\quad \\ \hline \end{array}$$

Use the squares to help you do Exs. 9–15:

9. $\frac{3}{4} + \frac{1}{4}$ $\qquad 2\frac{1}{4} + \frac{1}{4}$ $\qquad 3\frac{1}{4} + \frac{3}{4}$

10. $1 - \frac{1}{4}$ $\qquad 2\frac{1}{2} - \frac{1}{4}$ $\qquad 2\frac{1}{2} - \frac{3}{4}$

11. $4 \times \frac{1}{4}$ $\qquad 2 \times 1\frac{1}{4}$ $\qquad 2 \times \frac{3}{4}$

12. $\frac{5}{4} + \frac{3}{4}$ $\qquad 5 - 1\frac{3}{4}$ $\qquad 3 \times \frac{3}{4}$

13. How many fourths are there in 1? in 2? in $2\frac{1}{2}$? in $2\frac{3}{4}$?

14. 3 dollars = $\underline{\ ?\ }$ quarters.
    4 hours = $\underline{\ ?\ }$ quarter hours.
    2 lb. = $\underline{\ ?\ }$ quarter pounds.

15. Ann needs 2 lb. of potato chips. How many $\frac{1}{2}$-lb. bags must she buy? How many $\frac{1}{4}$-lb. bags?

Problems with fractions

These problems can be solved by counting with fractions, by drawing diagrams, or by using the pictures of fractions on pages 42–43. How many different ways can you find to work each problem?

1. Mary weighs $74\frac{3}{4}$ pounds. How much must she gain to weigh exactly 75 pounds?

2. Nancy bought $3\frac{1}{2}$ yards of material. How much less than 4 yards is this?

3. Betty is looking for ribbon $2\frac{3}{4}$ inches wide. The clerk showed her a piece that was $2\frac{1}{4}$ inches wide. Betty said, "That is _?_ inch too narrow."

4. Ten quarters make how many dollars?

5. Ann's apple-tart recipe calls for $\frac{1}{2}$ cup of sugar, half white and half brown. How much brown sugar should she use? How much white?

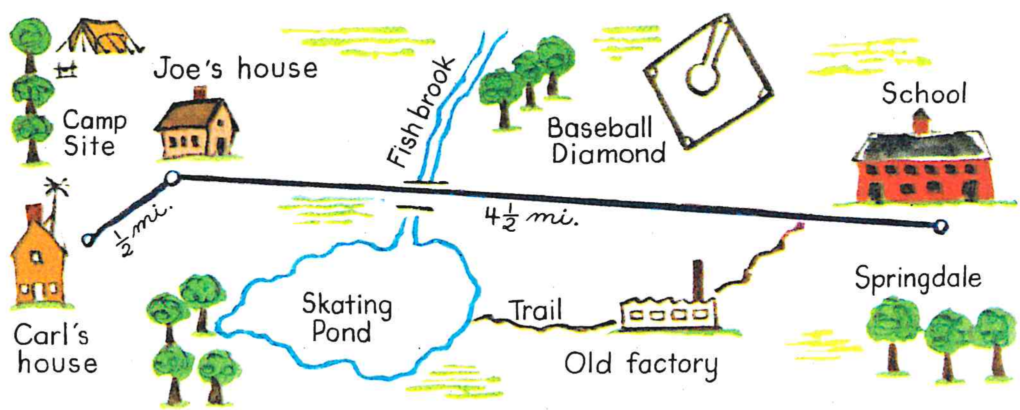
6. Ted often rides his bicycle to visit his grandmother, who lives four miles from his house. How much farther does he have to ride after he has gone $2\frac{3}{4}$ miles?

7. At the Lincoln School a quarter hour is given for recess each morning. How much time does this amount to in a week?

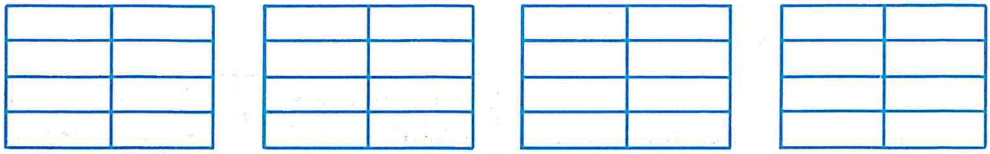
8. A recipe calls for $\frac{3}{4}$ cup of sugar. How much sugar will you use if you double the recipe?

9. How many quarter-pound sticks of butter are there in 2 pounds? in 3 pounds? in 4 pounds?

10. Carl drew the map below. Can you figure out how far he lives from Springdale?



Learning about eighths



1. Each of these four equal rectangles is divided into eighths. In all, there are ___?___ eighths.

2. Use two strips of paper to cover parts of the rectangles so that you see only:

$\frac{3}{8}$ $\quad \frac{8}{8}$ $\quad 1\frac{5}{8}$ $\quad \frac{16}{8}$ $\quad 2\frac{1}{8}$ $\quad 3\frac{7}{8}$ $\quad 1\frac{6}{8}$ $\quad 2\frac{1}{2}$

3. Begin with $\frac{1}{8}$ and count by eighths to 4.

4. When you count by eighths, what comes just after $5\frac{7}{8}$? just before 10?

5. What could you say instead of $\frac{4}{8}$? instead of $\frac{2}{8}$? $\frac{6}{8}$?

6. Which is more, $3\frac{1}{2}$ or $3\frac{3}{8}$? $2\frac{3}{4}$ or $2\frac{6}{8}$? Use the picture to prove your answers.

7. Begin with 2 and count to 4 by eighths.

8. Begin with $4\frac{1}{8}$ and count backward by eighths to $3\frac{5}{8}$.

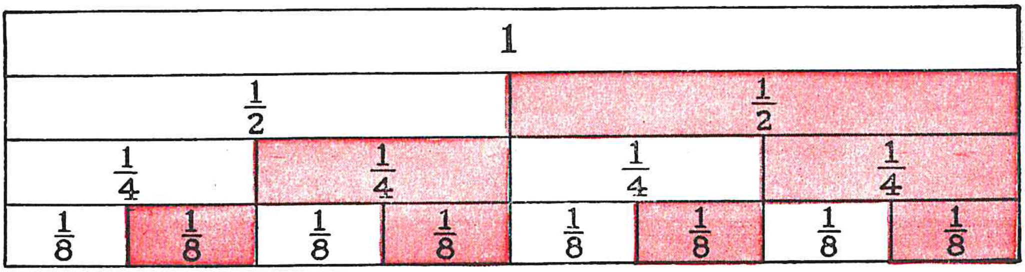
Copy the following and fill in the missing numbers:

9.	$\frac{1}{2}$	1	$1\frac{1}{2}$	?	?	?	?	4
10.	$\frac{1}{2}$	$\frac{2}{2}$	$\frac{3}{2}$	?	?	?	?	$\frac{8}{2}$
11.	$\frac{11}{8}$	$\frac{10}{8}$	$\frac{9}{8}$	?	?	?	?	$\frac{4}{8}$
12.	$3\frac{2}{4}$	$3\frac{3}{4}$	?	?	$4\frac{2}{4}$	?	?	$5\frac{1}{4}$
13.	$5\frac{2}{4}$	$5\frac{1}{4}$	?	?	$4\frac{2}{4}$	?	?	$3\frac{3}{4}$

Use the rectangles above to help you in these:

14.	$\frac{8}{8} = \underline{?}$	$\frac{16}{8} = \underline{?}$	$\frac{24}{8} = \underline{?}$	$\frac{32}{8} = \underline{?}$	$1\frac{1}{4} = \frac{?}{8}$
15.	$\frac{12}{8} = \underline{?}$	$\frac{20}{8} = \underline{?}$	$\frac{10}{8} = \underline{?}$	$\frac{28}{8} = \underline{?}$	$\frac{3}{4} = \frac{?}{8}$

Families of fractions



1. This chart shows that:

$1 = \frac{?}{2} = \frac{?}{4} = \frac{?}{8}$ $\quad \frac{1}{2} = \frac{?}{8}$ $\quad \frac{1}{4} = \frac{?}{8}$ $\quad \frac{3}{4} = \frac{?}{8}$ $\quad \frac{1}{2} = \frac{?}{4}$

2. Which is larger? $\frac{3}{4}$ or $\frac{1}{2}$ $\quad \frac{3}{8}$ or $\frac{1}{4}$ $\quad \frac{3}{4}$ or $\frac{3}{8}$ $\quad \frac{5}{8}$ or $\frac{1}{2}$

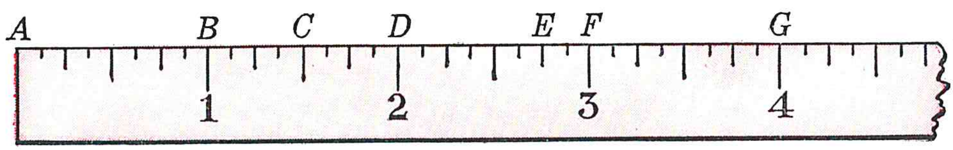
3. $\frac{3}{8} + \frac{5}{8} = \underline{\ ?\ }$ $\quad \frac{1}{2} + \frac{1}{4} = \underline{\ ?\ }$ $\quad \frac{1}{2} + \frac{1}{8} = \underline{\ ?\ }$ $\quad \frac{4}{8} + \frac{1}{2} = \underline{\ ?\ }$

4. $1 - \frac{1}{2} = \underline{\ ?\ }$ $\quad 1 - \frac{1}{4} = \underline{\ ?\ }$ $\quad 1 - \frac{1}{8} = \underline{\ ?\ }$ $\quad \frac{1}{2} - \frac{1}{4} = \underline{\ ?\ }$

5. How many eighths are there in 1? in $\frac{1}{2}$? in $\frac{1}{4}$? in $\frac{3}{4}$?

6. $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} = \frac{?}{8}$ $\quad \frac{3}{4} + \frac{1}{8} = \frac{?}{8}$ $\quad \frac{3}{8} + \frac{3}{8} = \frac{?}{8} = \frac{?}{4}$

7. $\frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} = \frac{?}{8} = \frac{?}{4}$ $\quad \frac{1}{2} + \frac{3}{8} = \frac{?}{8}$ $\quad 6 \times \frac{1}{8} = \frac{?}{8} = \frac{?}{4}$



Use the ruler above to help you find these missing numbers:

8. From A to D is $\underline{\ ?\ }$ in., or $\frac{?}{2}$ in., or $\frac{?}{4}$ in., or $\frac{?}{8}$ in.

9. From A to B is $\underline{\ ?\ }$ in.; from B to C is $\underline{\ ?\ }$ in.

10. From A to E is $\underline{\ ?\ }$ in.; from E to G is $\underline{\ ?\ }$ in.

11. From A to C is $\frac{?}{8}$ in., or $\frac{?}{4}$ in.

12. Subtract $\frac{1}{8}$ in. from 2 in. The remainder is $\underline{\ ?\ }$ in.

13. Start at $1\frac{1}{2}$ in. and go on $\frac{3}{8}$ in. You stop at $\underline{\ ?\ }$ in.

Note to Teacher: See Note 1 on page 310.

Be your own teacher

These problems can be solved by counting with fractions, by drawing diagrams, or by using the drawings on pages 42, 43, or 44. See how many different ways you can find to solve them.

1. A boys' club is collecting old newspapers to sell for money to buy a football.

On Monday, Jack collected $5\frac{1}{2}$ pounds of paper. On Tuesday, he collected $4\frac{5}{8}$ pounds. How many pounds of paper did he collect on both days?

2. It is $1\frac{1}{2}$ miles from the schoolhouse to Jim Bland's farm and another $\frac{7}{8}$ mile from the farm to the river. How far is it from the school to the river?

3. Jane has a sheet of paper $4\frac{1}{2}$ inches wide. If she divides it into 2 equal columns, how wide will each column be?

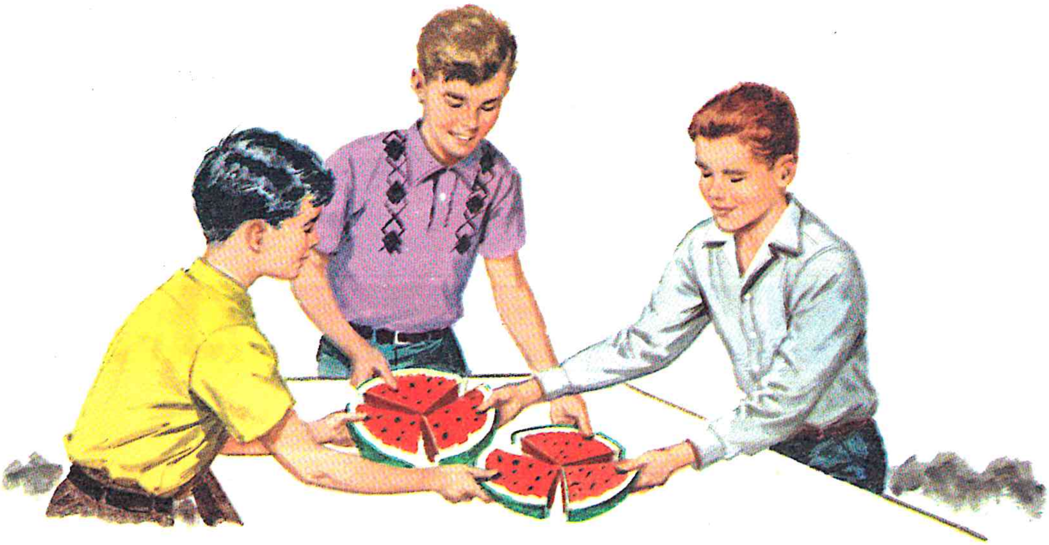
4. Jack weighs 74 lb. with shoes on. If his shoes weigh $1\frac{3}{8}$ lb., how much does Jack weigh without his shoes?

5. Ted nailed together two pieces of wood, each $\frac{5}{8}$ of an inch thick, to make a block. How thick was the block?

6. Jane had a piece of ribbon $2\frac{1}{4}$ yards long. She cut off 2 pieces each $\frac{3}{4}$ yard long. How much ribbon did she have left?

7. Look at the picture. Tom's pail and pig together weigh _?_ pounds. The pail weighs $1\frac{1}{2}$ pounds. How much does his pig weigh?

To the Teacher: See Note 2 on page 310.



Dividing a number by a larger number

1. Jim's sister cut two slices from a melon. "Divide these among you," she said to Jim and his two friends.

"How shall I divide 2 slices among 3 of us?" asked Jim.

"I know," replied Tom. "Cut one slice into three equal parts. Then each of us can have a __?__ of a slice.

"Cut the other slice the same way. Then we'll each have another third of a slice."

Look at the picture. How many thirds of a slice does each boy get?

- $\frac{1}{3}$ of 2 slices $= \frac{2}{3}$ of a slice.
- 2 slices $\div 3 = \frac{2}{3}$ of a slice.

$\boxed{\frac{1}{3} \text{ of } 2 = \frac{2}{3}}$ $\boxed{2 \div 3 = \frac{2}{3}}$

2. Jerry has 3 cookies to divide among 4 boys. Draw the 3 cookies. Divide the first cooky among the 4 boys; the second cooky; the third cooky.

What part of each cooky does each boy get? What part of a cooky does each boy get in all?

Tell how the cookies show that:

$\boxed{3 \div 4 = \frac{3}{4}}$ $\boxed{\frac{1}{4} \text{ of } 3 = \frac{3}{4}}$

3. Draw 4 bricks of ice cream. Draw lines to divide each brick among 5 boys. What part of a brick does each boy get in all?

Tell how the bricks show that:

$\boxed{4 \div 5 = \frac{4}{5}}$ $\boxed{\frac{1}{5} \text{ of } 4 = \frac{4}{5}}$

4. Draw diagrams to show:

- two cookies shared by 3 boys.
- three sticks of candy shared by 4 children.
- five chocolate bars shared by 6 girls.

5. Tell which drawing in Ex. 4 shows that:

$3 \div 4 = \frac{3}{4}$ $\quad 5 \div 6 = \frac{5}{6}$ $\quad 2 \div 3 = \frac{2}{3}$

6. Complete these:

$\frac{3}{4}$ means 3 divided by _?_
$\frac{5}{6}$ means 5 divided by _?_
$\frac{2}{3}$ means _?_ divided by 3

7. Jim has 3 oranges to divide among 4 boys. Will each boy get more than a whole orange, or a very small part of an orange, or nearly a whole orange?

8. What part of an orange will each boy in Ex. 7 get?

$\frac{1}{4}$ of 3 = _?_ $\qquad 3 \div 4 =$ _?_

9. If 6 boys share 2 doughnuts, will each boy get more than a whole doughnut, or a very small piece of doughnut, or nearly a whole doughnut?

10. What part of a doughnut will each boy in Ex. 9 get?

$\frac{1}{6}$ of 2 = _?_ $\qquad 2 \div 6 =$ _?_

11. $1 \div 3 =$ _?_ $\qquad 2 \div 3 =$ _?_
$\frac{1}{4}$ of 3 = _?_ $\qquad \frac{1}{3}$ of 2 = _?_

12. Eric has 2 small cakes to divide among 3 boys. What part of a cake will each get?

$\frac{1}{3}$ of 2 = _?_ $\qquad 2 \div 3 =$ _?_

13. If you have 3 dollars to divide among 5 persons, what part of a dollar will each get?

$\frac{1}{5}$ of 3 = _?_ $\qquad 3 \div 5 =$ _?_

14. Four girls have 2 apples to share equally.

Joan says, "Each of us will get $\frac{2}{4}$ apple." Polly says, "We'll each get $\frac{1}{2}$ apple."

Prove that both girls are right.

15. Will each of you get more melon if 3 of you share 2 melons than if 5 of you share them?

Then which is more, $\frac{2}{3}$ or $\frac{2}{5}$?

16. Will you get more candy if 4 of you share 3 candy bars or if 8 of you share them?

Then which is more, $\frac{3}{4}$ or $\frac{3}{8}$?

17. Four boys together earned 3 dollars for cleaning Mrs. North's garage. If they share the money equally, will each get more than a dollar or less than a dollar?

If 4 boys share \$1, what part of a dollar will each get? Then what part of a dollar will each get if they share \$3?

$3 \div 4 =$ _?_ $\qquad \frac{1}{4}$ of 3 = _?_

Written practice

Add and check:

	a	b	c	d	e	f
1.	24	74	876	825	104	765
	56	56	239	936	97	421
	79	903	405	98	654	90
	83	24	74	476	321	322

Subtract and check:

2.	467	905	832	5006	6983	3270
	283	479	779	2784	2094	1648

Multiply. Check by going over your work.

3.	25	306	472	682	8467	9270
	47	95	905	29	9	8
4.	68	460	567	459	9623	7097
	39	39	803	86	8	7

Finding sensible answers

Without using a pencil, find in each B column an answer that matches each example in the A column.

	A	B		A	B
1.	$39 + 48$	about 80	2.	$304 + 193$	about 600
	4×26	about 90		$800 - 389$	about 500
	$140 - 59$	about 100		20×32	about 400

	A	B		A	B
3.	20×42	2520	4.	10×75	a 5-figure number
	40×42	1680		100×75	a 3-figure number
	60×42	840		1000×75	a 4-figure number

Finding the missing number

1. What 2 multiplication facts does this dot picture show? What 2 division facts? If you know that $3 \times 6 = 18$, what 2 division facts do you know?

2. What 2 division facts can you learn from each of these?

$7 \times 9 = 63$ $\quad$ $6 \times 7 = 42$
$9 \times 5 = 45$ $\quad$ $8 \times 9 = 72$

3. Jane said, "I'm thinking of a number. *That number* times 6 is 54. What is the number?"

What division fact do you use to find the number Jane has in mind?

4. Tom said, "I'm thinking of a number. Eight times *that number* is 40. What is the number?"

What division fact do you use to find the number Tom has in mind?

5. Peter said, "Nine times the number I have in mind equals 54. What is the number?"

What division fact do you use to find the number Peter has in mind?

6. Make up some "I'm Thinking of a Number" questions to ask your class. Have your classmates tell what division facts they use to find the numbers.

What division facts do you use to find the answers to each of these questions?

7. What number $\times 8 = 24$?

8. What number $\times 5 = 35$?

9. What number $\times 7 = 42$?

10. Six $\times$ what number $= 24$?

11. Seven $\times$ what number $= 49$?

12. Nine $\times$ what number $= 72$?

Here is a short way to write Ex. 7: $N \times 8 = 24$.

The N stands for the number you want to find.

13. Write Exs. 7–12, using N. Then tell what division you do to find what number N stands for.

What number does N stand for in each of these?

14. $N \times 6 = 48$ $\quad$ $N \times 7 = 28$

15. $4 \times N = 16$ $\quad$ $N \times 6 = 30$

16. $5 \times N = 30$ $\quad$ $9 \times N = 81$

17. $5 \times N = 15$ $\quad$ $N \times 8 = 32$

18. $6 \times N = 18$ $\quad$ $N \times 9 = 45$

19. $N \times 7 = 56$ $\quad$ $8 \times N = 64$

20. $9 \times N = 63$ $\quad$ $N \times 4 = 36$

To the Teacher: See Note 3 on page 310.

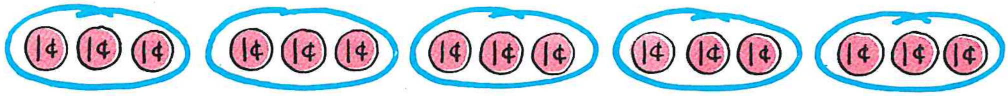
UNIT 7

Meaning of division
Division in measurement and partition problems
Remainders expressed as fractions

One use of division

Miss Morgan asked her pupils to see how many ways they could do this problem: How many 3-cent stamps can you buy for 15¢?

How would you do the problem? This is how some of Miss Morgan's pupils did it:



① Don drew the 15¢. Then he drew a line around each group of 3¢. His drawing shows that for 15¢ he can buy __?__ 3-cent stamps. Don's work shows that 15 ÷ 3 = 5.

② Bill wrote 15¢. Then he subtracted 3¢ over and over as many times as he could:
His work shows that 3¢ can be taken out of 15¢ __?__ times. He can buy __?__ 3-cent stamps. Bill's work shows you that 15 ÷ 3 = 5.

$$\begin{array}{r} 15¢ \\ -\ 3¢\ \checkmark \\ \hline 12¢ \\ -\ 3¢\ \checkmark \\ \hline 9¢ \\ -\ 3¢\ \checkmark \\ \hline 6¢ \\ -\ 3¢\ \checkmark \\ \hline 3¢ \\ -\ 3¢\ \checkmark \\ \hline 0¢ \end{array}$$

③ Ann said, "We have to find *what number of stamps* times 3¢ equals 15¢. I'll write: N × 3¢ = 15¢. To find what number N stands for, I'll divide 15¢ by 3¢.

"15¢ ÷ 3¢ = 5. N stands for 5. I can get five 3-cent stamps for 15¢." Do a multiplication to prove that Ann is right.

1. Show how Don, Bill, and Ann would find how many 2-cent balloons they can get for 16¢.

Does each one find 16 ÷ 2 = 8? Multiply to prove they are right.

Whose method is easiest and shortest?

2. How many groups of 7 days are there in 56 days? N × 7 = 56.

Why should you divide to find what number N stands for?

3. Tom says, "I use division to find how many groups of a certain size there are in another group." Make up some problems to show Tom's use of division.

4. Dan says, "I use division to find the number of times one number is contained in another." Make up some problems to illustrate what he means.

5. If N × 4 = 36, then N = __?__.

Another use of division

Six girls want to share equally 30 bracelet charms. Do you know how many each should take?

① Marie said, "We should each take $\frac{1}{6}$ of 30 charms. To find $\frac{1}{6}$ of 30, just divide 30 by 6.

"$30 \div 6 = 5$. We should each take 5 charms."

② Rita said, "That's right. I think of it this way: 6 × *the number we each get* = 30.

"I write $6 \times N = 30$.

"To find what number N stands for, just divide 30 by 6. $30 \div 6 = 5$; so N stands for 5. We should each take 5 charms."

1. Prove by a multiplication that if each of the 6 girls takes 5 charms, they will be sharing all of their 30 charms.

Tell how Marie would think when she does Exs. 2–5. Tell how Rita would think. Do a multiplication to prove each answer.

2. If 5 boys share 45 marbles equally, each will get __?__ marbles.

3. Four girls bought a card of bobby pins for 20¢. There were 36 bobby pins on the card.

What is each girl's share of the cost? share of the bobby pins?

4. If 27 children divide up into 3 equal teams, how many children will there be on each team?

5. When you cut a number of things into a certain number of equal parts, you use division to find how many are in each part. Show what this means.

Practice in dividing

1. Read each example and tell how to find the answer:

- $26 \div 6$ • $6\overline{)26}$ • $\frac{1}{6}$ of 26 • $N \times 6 = 26$ • $6 \times N = 26$
- How many 6's are there in 26?
- If 26 is divided into 6 equal parts, how many are in each part?

2. How many 6-inch stakes can Jim cut from a strip of wood 26 inches long?

To find out, you must divide _?_ by _?_. This division shows Jim can cut _?_ stakes; he has _?_ inches of wood left.

In a division example, the number to be divided is the ***dividend.*** The number you divide by is the ***divisor.*** The answer is the ***quotient.*** The number left is the ***remainder.*** In this example, $24 \div 6 = 4$ is your Helping Fact.

$$\begin{array}{lrl} \text{quotient} & 4\text{ r}2 & \\ \text{divisor} & 6\overline{)26} & \text{dividend} \\ & \underline{24} & \\ & 2 & \text{remainder} \end{array}$$

Check

$4 \times 6 = 24$

$24 + 2 = 26$

3. In the boxed division above, name the dividend, the divisor, the quotient, the remainder. Explain the check.

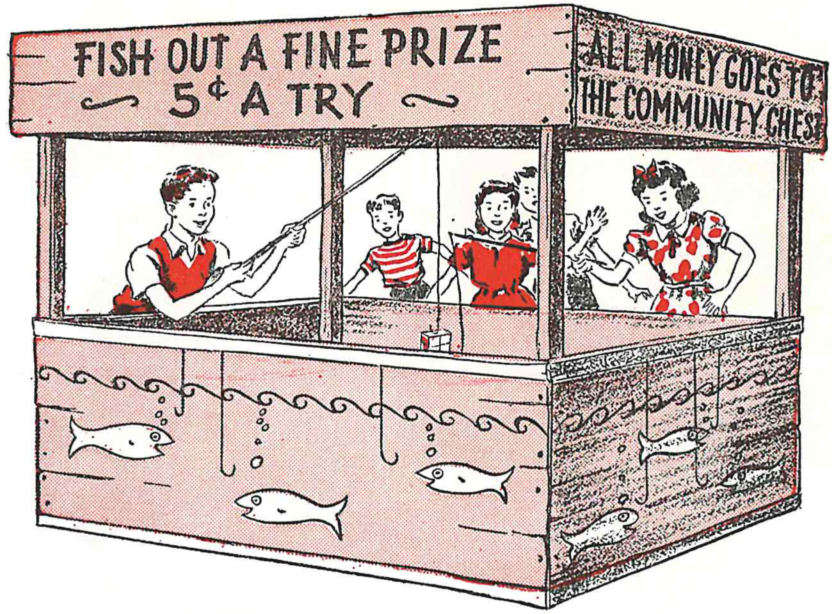
4. Turn to page 308 and take the test on the division facts.

5. Explain how each of these divisions is done. Then divide each number from 32 to 38 by 6.

$$\begin{array}{r} 4\text{ r}4 \\ 6\overline{)28} \\ \underline{24} \\ 4 \end{array} \qquad \begin{array}{r} 4\text{ r}5 \\ 6\overline{)29} \\ \underline{24} \\ 5 \end{array} \qquad \begin{array}{r} 5 \\ 6\overline{)30} \\ \underline{30} \\ \end{array} \qquad \begin{array}{r} 5\text{ r}1 \\ 6\overline{)31} \\ \underline{30} \\ 1 \end{array}$$

In Ex. 6a, your Helping Fact is $9\overline{)45}$. Name your Helping Fact in each division. Divide. Then tell each dividend, divisor, quotient, and remainder.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
6.	$9\overline{)50}$	$7\overline{)61}$	$4\overline{)35}$	$8\overline{)41}$	$5\overline{)46}$	$6\overline{)57}$	$7\overline{)39}$	$8\overline{)76}$
7.	$5\overline{)38}$	$9\overline{)68}$	$6\overline{)47}$	$8\overline{)36}$	$7\overline{)33}$	$9\overline{)87}$	$6\overline{)53}$	$9\overline{)33}$
8.	$5\overline{)29}$	$9\overline{)57}$	$4\overline{)31}$	$9\overline{)76}$	$6\overline{)38}$	$8\overline{)70}$	$6\overline{)35}$	$4\overline{)39}$



Earning for the Community Chest

Miss Grove's fifth-grade pupils wanted to earn money for the Community Chest, so they decided to have a fishpond.

1. The boys brought 79 prizes for the fishpond, and the girls brought 119. They had __?__ prizes in all.

2. They wrapped each prize in paper. Joan wrapped 19, Esther wrapped 32, Peter wrapped 26, Edna wrapped 28, Tom wrapped 27, and Allan wrapped the rest. How many did Allan wrap?

3. There were 119 children who paid 5¢ each to fish out a prize. The class collected __?__ from these children.

4. After 119 of the 198 prizes were fished out, how many prizes were left in the pond?

5. The class reduced the price to 3¢ a try. Then 56 children fished out a prize. The class collected __?__ from them.

6. How many prizes were left in the fishpond then?

7. The class let some children fish out all the rest of the prizes for 2¢ a try. From these children the class collected __?__.

8. Use your answers to Exs. 3, 5, and 7 to find how much the pupils in Miss Grove's class earned at their fishpond.

Dividing the remainder

Sue, Jane, and Nancy were making Halloween cards. They had 4 sheets of yellow paper to divide equally.

Nancy said, "We can each take a whole sheet. Then we can cut the other sheet into thirds and each of us can take one third. When we do that, we shall each have one sheet and $\frac{1}{3}$ of a sheet."

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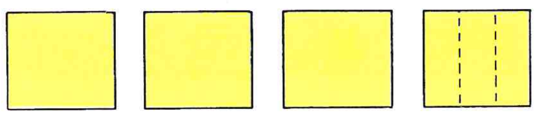
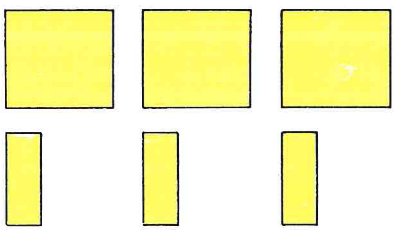


AFTER SHARING



$\frac{1}{3}$ of 4 sheets $= 1\frac{1}{3}$ sheets
4 sheets $\div 3 = 1\frac{1}{3}$ sheets

$\frac{1}{3}$ of $4 = 1\frac{1}{3}$
$4 \div 3 = 1\frac{1}{3}$

Draw pictures to show these facts:

1. $\frac{1}{3}$ of 5 cookies $= 1\frac{2}{3}$ cookies
2. $\frac{1}{3}$ of 6 cookies $= 2$ cookies
3. $\frac{1}{3}$ of 7 cookies $= 2\frac{1}{3}$ cookies
4. $\frac{1}{3}$ of 8 cookies $= 2\frac{2}{3}$ cookies
5. $\frac{1}{3}$ of 9 cookies $= 3$ cookies
6. $\frac{1}{3}$ of 10 cookies $= 3\frac{1}{3}$ cookies
7. $\frac{1}{3}$ of 11 cookies $= 3\frac{2}{3}$ cookies
8. $\frac{1}{3}$ of 12 cookies $= 4$ cookies

Sue, Jane, and Nancy had 14 sheets of orange paper to divide equally. Jane said, "Wait. I'll figure out exactly how many each of us should get."

$$\begin{array}{r} 4^{2} \\ 3\overline{)14} \\ \underline{12} \\ 2 \end{array}$$

She wrote $3\overline{)14}$ and divided as shown in the first box. Explain her division. Notice how she wrote the remainder 2 in the answer.

Then Jane wrote the divisor 3 under the remainder 2 as shown in the second box.

$$\begin{array}{r} 4\frac{2}{3} \\ 3\overline{)14} \\ \underline{12} \\ 2 \end{array}$$

Her work shows that $14 \div 3 = 4\frac{2}{3}$.

How many sheets should each girl get? Draw a diagram to prove your answer.

Copy these examples without the answers. Work them. Then look to see if your answers are correct.

	a	*b*	*c*	*d*	*e*	*f*	*g*
9.	$\begin{array}{r}1\frac{1}{3}\\3\overline{)4}\end{array}$	$\begin{array}{r}1\frac{2}{5}\\5\overline{)7}\end{array}$	$\begin{array}{r}2\frac{1}{3}\\3\overline{)7}\end{array}$	$\begin{array}{r}2\frac{2}{5}\\5\overline{)12}\end{array}$	$\begin{array}{r}3\frac{1}{6}\\6\overline{)19}\end{array}$	$\begin{array}{r}3\frac{5}{8}\\8\overline{)29}\end{array}$	$\begin{array}{r}3\frac{1}{5}\\5\overline{)16}\end{array}$
10.	$\begin{array}{r}1\frac{1}{7}\\7\overline{)8}\end{array}$	$\begin{array}{r}1\frac{2}{3}\\3\overline{)5}\end{array}$	$\begin{array}{r}2\frac{1}{4}\\4\overline{)9}\end{array}$	$\begin{array}{r}4\frac{5}{7}\\7\overline{)33}\end{array}$	$\begin{array}{r}4\frac{1}{5}\\5\overline{)21}\end{array}$	$\begin{array}{r}9\frac{1}{6}\\6\overline{)55}\end{array}$	$\begin{array}{r}9\frac{1}{4}\\4\overline{)37}\end{array}$

Divide, giving the remainders as fractions:

	a	*b*	*c*	*d*	*e*	*f*	*g*
11.	$5\overline{)31}$	$9\overline{)29}$	$6\overline{)29}$	$5\overline{)33}$	$8\overline{)55}$	$8\overline{)21}$	$6\overline{)41}$
12.	$7\overline{)45}$	$8\overline{)29}$	$8\overline{)27}$	$8\overline{)33}$	$9\overline{)55}$	$6\overline{)53}$	$4\overline{)29}$
13.	$6\overline{)43}$	$7\overline{)29}$	$9\overline{)27}$	$9\overline{)33}$	$6\overline{)55}$	$7\overline{)41}$	$4\overline{)27}$
14.	$5\overline{)46}$	$5\overline{)29}$	$5\overline{)27}$	$4\overline{)33}$	$7\overline{)55}$	$9\overline{)74}$	$6\overline{)33}$

15. If 3 girls share equally 20 yards of ribbon, how many yards will each get?

16. If 5 boys share equally 2 dozen sandwiches, how many will each get?

17. Is $3 \div 5$ more than 1?

18. Is $5 \div 3$ more than 1?

19. Is $7 \div 2$ more than 1?

20. Make up a problem to illustrate the divisions in Exs. 17–19.

When to divide the remainder

▶ Jim had 22 sticks of candy to divide among 3 boys.

$$\begin{array}{r} 7\frac{1}{3} \\ 3\overline{)22} \end{array}$$

He gave each boy 7 sticks and had 1 stick left over.

Then he broke the stick that was left over into 3 equal parts.

Each boy got 7 whole sticks and $\frac{1}{3}$ of a stick, or $7\frac{1}{3}$ sticks.

In Jim's division, we say that he divided the remainder, or *expressed the remainder as a fraction.*

▶ Tom had 22 marbles to divide among 3 boys. He said, "Each of you can have 7 marbles, but I can't divide the one marble that's left over." Could each boy get $7\frac{1}{3}$ marbles?

Whether or not you divide the remainder in a division example depends upon the problem.

1. Would you divide the remainder if you were:

- dividing 5 cookies between 2 girls?
- dividing 10 valentines among 3 girls?

Tell the answers. Notice the ways division is written and used.

2. $72 \div 9 = \underline{\ ?\ }$.

3. 81 divided by 9 is $\underline{\ ?\ }$.

4. There are $\underline{\ ?\ }$ 9's in 36.

5. 6 in 36, $\underline{\ ?\ }$ times.

6. $\frac{1}{8}$ of 40 is $\underline{\ ?\ }$.

7. 7 is contained in 28 $\underline{\ ?\ }$ times.

8. If 9 toys at the same price cost 54¢ in all, one toy costs $\frac{1}{9}$ of 54¢, or $\underline{\ ?\ }$¢.

9. How many 5-cent balls can you buy for 25¢?

10. $4 \div 5 = \underline{\ ?\ }$ $5 \div 4 = \underline{\ ?\ }$

11. $\frac{20}{2} = 20 \div 2 = 2\overline{)20} = \underline{\ ?\ }$.

12. $\frac{1}{6}$ of 27 equals:
$27 \div 6 = \frac{27}{6} = 6\overline{)27} = \underline{\ ?\ }$.

13. $9\overline{)40}$ means "How many $\underline{\ ?\ }$ are there in 40?"

14. In $N \times 6 = 54$, N stands for $54 \div 6$, or $\underline{\ ?\ }$.

15. In $7 \times N = 35$, N stands for $35 \div 7$, or $\underline{\ ?\ }$.

16. Make up a rule for checking a division. In your rule use the words *divisor, quotient, dividend,* and *remainder.*

Dividing larger numbers

Carl packs apples in boxes to sell. Each box holds $\frac{1}{2}$ doz. apples. How many boxes does he need for 139 apples?

Carl thought, "Each box holds 6 apples.

"10 boxes will not be enough, because 10 × 6 apples is only 60 apples.

"20 boxes will not be enough, because 20 × 6 apples is only 120 apples.

"30 boxes will be too many, because 30 × 6 apples is 180 apples.

"I need '20-some' boxes." Explain.

Then Carl divided 139 by 6 as shown here:⟶

$$\begin{array}{r} 23 \\ 6\overline{)139} \\ \underline{120} \\ 19 \\ \underline{18} \\ 1 \end{array} \qquad \begin{array}{r} \textbf{Check} \\ 23 \\ \underline{\times 6} \\ 138 \\ \underline{+1} \\ 139 \end{array}$$

1. Tell how Carl's division shows these things:

- In 20 boxes he can pack 120 apples. (Does the 2 in tens place in the quotient mean 20?)
- Then he has 19 more apples to pack.
- To pack 19 apples, he needs 19 ÷ 6, or 3 boxes.
- In all, he packs __?__ boxes, and has __?__ apple left.
- To check, he thinks, "23 boxes will hold 23 × 6 apples, or __?__ apples; 138 apples + 1 apple = __?__ apples."

2. To find how many boxes he needed to pack 237 apples, Carl thought:

"10 boxes are not enough. (Why?)

"30 boxes are not enough. (Why?)

"40 boxes are too many. (Why?)

"I'll need '30-some' boxes."

Then Carl did the work shown at the right. Explain it. He needs __?__ boxes, and has __?__ apples left over.

$$\begin{array}{r} 39 \\ 6\overline{)237} \\ \underline{180} \\ 57 \\ \underline{54} \\ 3 \end{array} \qquad \begin{array}{r} \textbf{Check} \\ 39 \\ \underline{\times 6} \\ 234 \\ \underline{+3} \\ 237 \end{array}$$

Dividing larger numbers

1. Try to find without help how many 7's there are in 419. Then study Exs. 2–6.

2. Here is the start of a Table of Sevens. Copy it and continue it up to $90 \times 7 = 630$.

$$\boxed{\begin{array}{l} 10 \times 7 = 70 \\ 20 \times 7 = 140 \end{array}}$$

3. Are there more than 10 sevens in 419? How do you know?

4. Are there more than 20 sevens? more than 30 sevens? more than 40 sevens? Why?

5. Are there as many as 60 sevens in 419?

How does the table show that in 419 there are more than 50 sevens and less than 60 sevens?

6. Explain this division:

$$\boxed{\begin{array}{rr} 59 \text{ r}6 & \textbf{Check} \\ 7\overline{)419} & 59 \\ \underline{350} & \underline{\times 7} \\ 69 & 413 \\ \underline{63} & \underline{+6} \\ 6 & 419 \end{array}}$$

- Does the 5 in tens place in the quotient stand for 50?
- Do 50 sevens = 350? Where is the 350 written in the division?
- Where does the 69 come from? the 9 in the quotient? the 63?

Tell about how many 7's there are in each number in Exs. 7–10.

Use the table you made in Ex. 5 to help you.

Answer this way: In dividing 174 by 7, my Helping Fact is $20 \times 7 = 140$. In 174 there are "20-some" sevens.

7.	174	462	356	86
8.	500	652	250	432
9.	225	295	94	243
10.	583	400	119	30

11. Now use the ***Hint System*** to find *about how many 7's* there are in each number in Exs. 7–10.

This is how the ***Hint System*** works: $17 \div 7 = 2$ r3 gives me a hint that $174 \div 7 =$ "20-some."

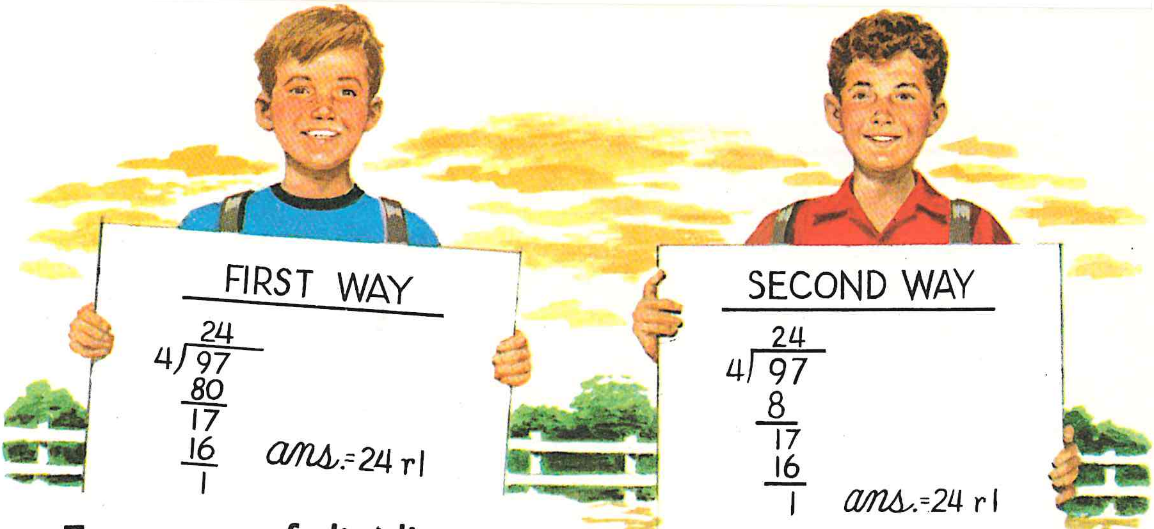
12. In Exs. 7–10 divide each number by 7; by 8; by 9. Use the ***Hint System.***

Check each answer.

13. Can you explain why the ***Hint System*** of finding the quotient works?

14. Are there about 20, or 30, eights in 250?

15. Are there about 50, or 60, sixes in 370?



Two ways of dividing

1. Above are two ways of dividing 97 by 4. Explain the First Way; the Second Way.

2. Does the 8 in the Second Way stand for the 80 in the First Way? An 8 written in tens place means _?_.

3. Where does the 17 come from in the First Way? in the Second Way?

Here are the steps you use to divide 97 by 4 in the Second Way:

▶ Divide: Use the Hint System. $9 \div 4 =$ _?_. Write the 2 above the 9 in tens place.

▶ Multiply: $2 \times 4 = 8$. Write the 8 under the 9.

▶ Subtract: $9 - 8 = 1$.

▶ Compare: The remainder is 1. Is it smaller than the divisor 4?

▶ Bring down the 7 of the 97. Write it with the 1, to make 17.

▶ Divide 17 by 4. Write the 4 above the 7 in the ones place.

▶ Multiply: $4 \times 4 = 16$. Where do you write the 16?

▶ Subtract: $17 - 16 = 1$.

▶ Compare: Is the remainder smaller than the divisor 4?

▶ The division shows that $97 \div 4 = 24$ r1. Check the answer.

4. The Second Way has 5 steps: *Divide, Multiply, Subtract, Compare, Bring down.* You just repeat these steps until you have finished the division. Show that this is true in dividing 97 by 4.

Divide each number below by 7; by 8; by 9. Do each division by the First Way; by the Second Way.

5.	246	356	573	95
6.	187	482	500	263
7.	583	374	126	435

To the Teacher: See Note 4 on page 310.

Three-figure quotients

1. Is the quotient in $7\overline{)5462}$

more than 10? $10 \times 7 = \underline{\ ?\ }$

more than 100? $100 \times 7 = \underline{\ ?\ }$

more than 1000? $1000 \times 7 = \underline{\ ?\ }$

2. Would the answer to the division in Ex. 1 be a 2-figure number? a 3-figure number? Explain.

3. How can you tell that the quotient in Ex. 1 could not be a 4-figure number?

If you divide each of these numbers by 8, how many figures will there be in the quotient? Explain.

4.	279	897	2456	5267
5.	389	974	4562	6420

6. Where is the first quotient figure written if the quotient is a 2-figure number? a 3-figure number? Explain.

In Exs. 7–9 tell:

- *how many figures there will be in the quotient.*
- *where you will write the first quotient figure.*
- *what the first quotient figure will be. (Use the Hint System.)*

7.	$6\overline{)275}$	$8\overline{)3546}$	$9\overline{)2984}$
8.	$7\overline{)876}$	$5\overline{)3206}$	$7\overline{)4534}$
9.	$5\overline{)575}$	$6\overline{)1644}$	$8\overline{)2656}$

10. One of the divisions below is not started correctly. Which one is it? What is the matter with it?

$$\begin{array}{r}4\\7\overline{)2984}\end{array} \qquad \begin{array}{r}3\\3\overline{)975}\end{array} \qquad \begin{array}{r}5\\5\overline{)298}\end{array}$$

11. Do you estimate the quotient in $6\overline{)1748}$ to be between 200 and 300? nearer 300 than 200? Why?

12. The answers to these divisions are written below the examples. Without working the divisions, choose the sensible answer for each:

$5\overline{)2920}$ $\qquad 6\overline{)348}$ $\qquad 7\overline{)3395}$

Answers: 58 485 584

13. If you know that 300×7 is 2100, then is $2130 \div 7$:

- a little more than 30?
- a little more than 300?
- about 3000?

14. If you know that 600×7 is 4200, then you should know that $4195 \div 7$ is almost $\underline{\ ?\ }$.

15. If you know that $37 \div 5$ is a little more than 7, then you should know that:

- $372 \div 5$ is a little more than $\underline{\ ?\ }$.
- $3726 \div 5$ is a little more than $\underline{\ ?\ }$.

Three-figure quotients

Explain how each of these divisions is done by the First Way; by the Second Way. How are the two ways alike? different?

In Ex. 1, the 5 in the quotient stands for _?_; the 4 stands for _?_; the 6 stands for _?_.

Check each answer by estimating; then by multiplying.

FIRST WAY

$$\begin{array}{r} 546 \\ 1.\ 6\overline{)3276} \\ \underline{3000} \\ 276 \\ \underline{240} \\ 36 \\ \underline{36} \end{array}$$

SECOND WAY

$$\begin{array}{r} 546 \\ 1.\ 6\overline{)3276} \\ \underline{30} \\ 27 \\ \underline{24} \\ 36 \\ \underline{36} \end{array}$$

FIRST WAY

$$\begin{array}{r} 435\ \text{r}1 \\ 2.\ 7\overline{)3046} \\ \underline{2800} \\ 246 \\ \underline{210} \\ 36 \\ \underline{35} \\ 1 \end{array}$$

SECOND WAY

$$\begin{array}{r} 435\ \text{r}1 \\ 2.\ 7\overline{)3046} \\ \underline{28} \\ 24 \\ \underline{21} \\ 36 \\ \underline{35} \\ 1 \end{array}$$

FIRST WAY

$$\begin{array}{r} 507\ \text{r}2 \\ 3.\ 8\overline{)4058} \\ \underline{4000} \\ 58 \\ \underline{56} \\ 2 \end{array}$$

SECOND WAY

$$\begin{array}{r} 507\ \text{r}2 \\ 3.\ 8\overline{)4058} \\ \underline{40} \\ 5 \\ \underline{0} \\ 58 \\ \underline{56} \\ 2 \end{array}$$

FIRST WAY

$$\begin{array}{r} \$2.54 \\ 4.\ 6\overline{)\$15.24} \\ \underline{12.00} \\ \$\ 3.24 \\ \underline{3.00} \\ \$\ \ .24 \\ \underline{.24} \end{array}$$

SECOND WAY

$$\begin{array}{r} \$\,2.5\,4 \\ 4.\ 6\overline{)\$1\,5.2\,4} \\ \underline{1\,2} \\ 3\,2 \\ \underline{3\,0} \\ 2\,4 \\ \underline{2\,4} \end{array}$$

Tell (1) how many figures there will be in each quotient; (2) where you will write the first quotient figure; (3) what the first quotient figure will be. Then copy, divide, and check.

	a	b	c	d	e
5.	$6\overline{)810}$	$5\overline{)1235}$	$7\overline{)742}$	$9\overline{)5040}$	$8\overline{)\$2.82}$
6.	$5\overline{)1895}$	$7\overline{)1848}$	$9\overline{)3663}$	$8\overline{)2600}$	$6\overline{)\$20.76}$
7.	$7\overline{)623}$	$8\overline{)2152}$	$6\overline{)348}$	$5\overline{)3950}$	$9\overline{)\$33.21}$

Practice for mastery

Tell how many figures there will be in each quotient and where you should write the first quotient figure. Then divide and check. Express the remainders as fractions.

	a	*b*	*c*	*d*	*e*	*f*
1.	$5\overline{)68}$	$6\overline{)384}$	$7\overline{)359}$	$9\overline{)5436}$	$9\overline{)643}$	$8\overline{)\$4.64}$
2.	$6\overline{)81}$	$6\overline{)571}$	$7\overline{)560}$	$7\overline{)6860}$	$8\overline{)7253}$	$9\overline{)\$13.86}$
3.	$6\overline{)95}$	$5\overline{)129}$	$6\overline{)546}$	$4\overline{)2884}$	$6\overline{)3365}$	$8\overline{)\$22.88}$
4.	$6\overline{)73}$	$4\overline{)292}$	$8\overline{)720}$	$9\overline{)6372}$	$3\overline{)216}$	$5\overline{)\$21.35}$
5.	$6\overline{)84}$	$3\overline{)256}$	$9\overline{)810}$	$7\overline{)5694}$	$8\overline{)776}$	$6\overline{)\$38.34}$
6.	$7\overline{)95}$	$8\overline{)375}$	$4\overline{)208}$	$7\overline{)492}$	$7\overline{)5464}$	$8\overline{)\$6.64}$
7.	$8\overline{)94}$	$9\overline{)463}$	$7\overline{)634}$	$6\overline{)5432}$	$9\overline{)545}$	$7\overline{)\$6.09}$

8. For a skating club party, Edith needs to fill 8 paper candy baskets. She has 96 small candy hearts. How many hearts can she put in each basket?

9. Seven classes shared equally the cost of the set of books below. How much did each class pay?

How many books are in the set? What is the cost of each book?

Related division facts

1. Tom has 24¢. How many 4-cent pencils can he buy?

- If each pencil costs 2¢, or *half as much* as 4¢, can Tom buy *twice as many* pencils for 24¢? Explain.
- If each pencil costs 8¢, or *twice as much* as 4¢, can Tom buy *half as many* pencils for 24¢? Explain.

Figure out how the first division in each exercise below tells you the answer to the second division:

2. $96 \div 8 = 12$, so $96 \div 4 = \underline{\ ?\ }$

3. $144 \div 16 = 9$, so $144 \div 8 = \underline{\ ?\ }$

4. $72 \div 12 = 6$, so $72 \div 24 = \underline{\ ?\ }$

5. $360 \div 40 = 9$, so $360 \div 20 = \underline{\ ?\ }$

6. $288 \div 36 = 8$, so $288 \div 18 = \underline{\ ?\ }$

7. $600 \div 25 = 24$, so $600 \div 50 = \underline{\ ?\ }$

8. Exs. 2–7 will help you know the missing words in these rules:

- If the divisor is *cut in half* without changing the dividend, then the new quotient is $\underline{\ ?\ }$ as large as the old.
- If the divisor is *doubled* without changing the dividend, the new quotient is $\underline{\ ?\ }$ as large as the old.

9. Make up some divisions and some problems to illustrate the rules you made in Ex. 8.

10. When Joan took the division-facts test on page 308, she did not know the answer to $6\overline{)24}$. Her classmates made these suggestions for helping her learn it:

- Nan said, "You know that $12 \div 6 = 2$; so $24 \div 6$ equals twice 2, or 4." Explain.
- Sue suggested, "$24 \div 3 = 8$; so $24 \div 6$ must equal $\frac{1}{2}$ of 8, or 4." Explain.
- Tom said, "$4 \times 6 = 24$ tells you it takes 4 sixes to make 24; so $24 \div 6 = \underline{\ ?\ }$."
- Ted wrote the examples shown in the box. How do they show the answer to $24 \div 6$?

6 ✓	24
+ 6 ✓	− 6 ✓
12	18
+ 6 ✓	− 6 ✓
18	12
+ 6 ✓	− 6 ✓
24	6 ✓

- Jim said, "After you understand *why* $24 \div 6 = 4$, write the fact a dozen times to be sure you never forget it again.

11. Take the test on page 308.

- Make a list of all the facts that were hard for you, that you did not do, or that were wrong.
- Find the answer to each fact on your list in as many different ways as you can. (See Ex. 10.)
- Ask other pupils how they help themselves remember the facts that are hard for you.

Working for speed and accuracy

Work and check each example in these division tests. If you make more than one error in Test I, do Practice Set I on the next page; and so on.

▶ DIVISION TEST I

1. $6\overline{)78}$	**2.** $7\overline{)645}$	**3.** $8\overline{)98}$	**4.** $9\overline{)801}$	**5.** $6\overline{)574}$
6. $7\overline{)95}$	**7.** $8\overline{)675}$	**8.** $9\overline{)702}$	**9.** $6\overline{)497}$	**10.** $7\overline{)84}$

▶ DIVISION TEST II

1. $9\overline{)814}$	**2.** $8\overline{)645}$	**3.** $7\overline{)569}$	**4.** $4\overline{)3684}$	**5.** $9\overline{)635}$
6. $3\overline{)2499}$	**7.** $7\overline{)499}$	**8.** $6\overline{)429}$	**9.** $5\overline{)406}$	**10.** $8\overline{)248}$

▶ DIVISION TEST III

1. $9\overline{)\$4.77}$	**2.** $7\overline{)\$5.59}$	**3.** $5\overline{)\$4.90}$	**4.** $9\overline{)\$28.95}$
5. $8\overline{)\$3.84}$	**6.** $6\overline{)\$5.94}$	**7.** $4\overline{)\$3.93}$	**8.** $8\overline{)\$53.29}$

▶ DIVISION TEST IV

1. $8\overline{)6472}$	**2.** $9\overline{)5445}$	**3.** $6\overline{)4080}$	**4.** $7\overline{)6790}$
5. $9\overline{)7269}$	**6.** $7\overline{)5250}$	**7.** $6\overline{)4248}$	**8.** $8\overline{)6880}$

▶ DIVISION TEST V

1. Paul saw a brief case advertised for $2.25. He wants to order it and send stamps to pay for it. He can send either __?__ 3-cent stamps or __?__ 1-cent stamps.

2. If 5 boys buy a croquet set for $2.75 and share the cost equally, how much should each pay?

3. Roger has 50 arithmetic examples to work. He can get 9 examples on one sheet of paper. How many sheets of paper will he need in all?

4. Guy has saved 325 pennies. If he has them changed into nickels, how many nickels will he get?

Working for speed and accuracy

If you made any mistakes on the division checkup on page 66, you need this extra practice. Work these examples and check them. Then take the tests on page 66 again.

▶ PRACTICE SET I

1. $6\overline{)177}$	**2.** $7\overline{)149}$	**3.** $6\overline{)498}$	**4.** $9\overline{)711}$	**5.** $8\overline{)338}$
6. $7\overline{)544}$	**7.** $6\overline{)301}$	**8.** $8\overline{)649}$	**9.** $7\overline{)85}$	**10.** $9\overline{)792}$

▶ PRACTICE SET II

1. $7\overline{)579}$	**2.** $4\overline{)3248}$	**3.** $3\overline{)2769}$	**4.** $5\overline{)458}$	**5.** $8\overline{)648}$
6. $6\overline{)449}$	**7.** $9\overline{)725}$	**8.** $7\overline{)568}$	**9.** $9\overline{)815}$	**10.** $8\overline{)405}$

▶ PRACTICE SET III

1. $4\overline{)\$3.59}$	**2.** $5\overline{)\$4.49}$	**3.** $6\overline{)\$5.99}$	**4.** $8\overline{)\$52.53}$
5. $7\overline{)\$1.96}$	**6.** $6\overline{)\$1.69}$	**7.** $8\overline{)\$6.78}$	**8.** $7\overline{)\$34.96}$

▶ PRACTICE SET IV

1. $6\overline{)5208}$	**2.** $8\overline{)5664}$	**3.** $7\overline{)3563}$	**4.** $8\overline{)7928}$
5. $6\overline{)4896}$	**6.** $9\overline{)7659}$	**7.** $7\overline{)5595}$	**8.** $9\overline{)4578}$

▶ PRACTICE SET V

1. Russell is going to send $1.25 for a catcher's glove he saw pictured in a catalogue. He plans to pay for it with stamps.

He can send _?_ 3-cent stamps and two 1-cent stamps, or _?_ 1-cent stamps.

2. If 6 boys share equally the $96 expense of a 4-week camping trip, each should pay _?_.

3. If William sets out 80 tomato plants, 8 plants in a row, how many rows will he have?

Problem study

Try to solve these problems without a pencil. Read each problem carefully. Tell what it asks you to find. Next explain how to solve the problem. Then tell the answer.

1. Bob raised some ducks and gave 8 to Roy. He had 18 left. How many ducks did Bob raise?

2. Jim shook 70 pennies out of his penny bank. How many nickels can he get for 70 pennies?

3. The temperature at 7 A.M. was 36°. At 7 P.M. it was 64°. How many degrees had it risen?

4. At the fair, Louis saw a boat marked $1.75. He thought, "I can buy one like that at Weaver's store for $1.59 and save 16¢."

Was he right about the amount he could save?

5. Arthur's mother is saving $2 a week in a Christmas club. How much will she save in 50 weeks?

6. There are 36 pupils in Jerry's class. All but 7 have visited the Egyptian room at the museum. How many should be able to report on the Egyptians?

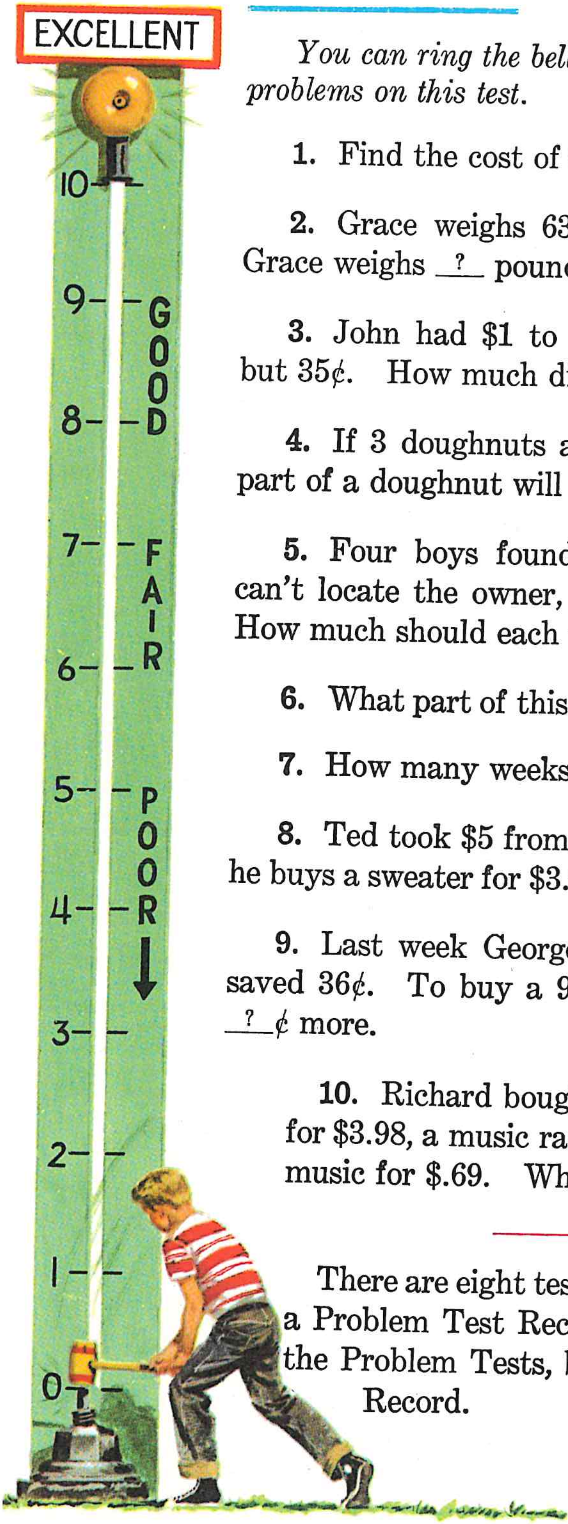
7. Three boys plan to buy a 75-cent kite. If they share the cost equally, each should pay _?_¢.

8. Al has 36 cents in his purse. He wants to buy two 25-cent magazines. He needs _?_¢ more.

9. If oranges cost 48 cents a dozen, how much must Mary Lou pay for a half-dozen oranges and a 40-cent cake?

10. Frank has saved $.80 to buy one of these magnets. How much more money does he need?

Problem Test 1



You can ring the bell in problem solving if you solve all 10 problems on this test.

1. Find the cost of 9 bus tickets at 8¢ each.

2. Grace weighs 63 pounds. May weighs 59 pounds. Grace weighs __?__ pounds more than May.

3. John had $1 to spend at a carnival. He spent all but 35¢. How much did he spend?

4. If 3 doughnuts are shared equally by 5 boys, what part of a doughnut will each one get?

5. Four boys found a purse containing $2.48. They can't locate the owner, so they want to share the money. How much should each take?

6. What part of this bar is colored? 

7. How many weeks are there in 84 days?

8. Ted took $5 from his school savings account. After he buys a sweater for $3.98, how much of the $5 has he left?

9. Last week George saved 48¢ and this week he has saved 36¢. To buy a 98-cent bicycle lamp, he must save __?__¢ more.

10. Richard bought a violin for $17.75, a violin case for $3.98, a music rack for $2.39, and a book of cowboy music for $.69. What was the total cost?

There are eight tests like this one in this book. Start a Problem Test Record. Every time you take one of the Problem Tests, be sure to write your score on the Record.

Arithmetic shorthand

1. In the Lincoln School the pupils often use arithmetic shorthand.

Instead of writing, "I am thinking of a number; if you add 7 to it, the sum will be 15," they write: $N + 7 = 15$. Can you find the number that N stands for?

What subtraction fact do you use to find N?

2. Instead of saying, "I am thinking of a number; if you subtract 7 from it, the remainder is 23," they say, "$N - 7 = 23$."

How do you find what number N stands for?

3. Instead of writing, "A certain number divided by 2 equals 5," they write: $\frac{N}{2} = 5$. $N = \underline{\ ?\ }$.

4. Instead of writing, "A certain number times 4 equals 32," they write: $N \times 4 = 32$. $N = \underline{\ ?\ }$.

Figure out the missing number, N, in Exs. 5–9. Tell how you find it.

5.	$N \times 5 = 35$	$20 - N = 15$
6.	$4 \times N = 48$	$N \div 2 = 50$
7.	$N + 8 = 20$	$50 \div N = 10$
8.	$6 + N = 15$	$N \times 50 = 200$
9.	$N - 12 = 20$	$10 \times N = 40$

10. If $N \div 5 = 4$, then N is 5×4, or $\underline{\ ?\ }$.

11. If $N + 80 = 100$, then N is $100 - 80$, or $\underline{\ ?\ }$.

12. If $2 \times N = 300$, then N is $300 \div 2$, or $\underline{\ ?\ }$.

13. In $N \times 4 = 480$, how do you find what N stands for?

Write the shorthand statement of the following. Then find what number N stands for.

14. "I am thinking of a certain number. If you multiply it by 7, the product is 161. What is the number?"

15. Albert had some cookies. After he ate 5 of them, he had 8 left. How many had he at first?

Hint: Let N stand for the number of cookies he had at first.

16. If John's money were shared equally by 8 of you, each would get 15¢. How much has he?

Hint: Let N stand for the amount of money John has.

17. George bought an apple and a 15-cent sandwich. His bill was 19¢.

How much did he spend for the apple? What will you let N stand for?

To the Teacher: See Note 3 on page 310.

Measuring your growth in arithmetic

Work carefully. Check your answers. Be sure every answer is sensible.

1. Copy, add, and check:
\$4.75 + \$12.39 + \$5.00 + \$.24.

2. From five dollars subtract \$2.47. Check.

3. Multiply 576 by 709.

4. Divide 4,459 by 6. Express the remainder as a fraction.

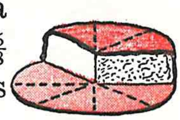
5. Take 8 thousand out of this number: 8,008,008. Then write in words the number that is left.

6. A passenger plane flew west at a height of 12,000 feet. On its eastbound trip it flew at a height of 9,000 feet.

How much higher did it fly on the trip westward than on the trip eastward?

7. There are 365 days in a year and there are 7 days in a week. Use these facts to show that there are 52 weeks and 1 day extra in a year.

8. If you have a whole cake and eat $\frac{5}{8}$ of it, how many eighths will be left?



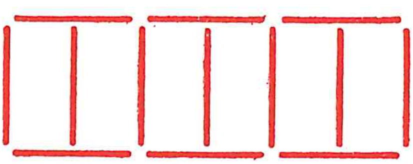
9. Pete has 3 doughnuts to divide equally among 4 boys. What part of a doughnut should each boy get? Draw a picture to prove your answer.

10. Eight boys bought a model airplane. It cost them \$2.40.

If the boys share the cost of the plane equally, how much should each boy pay?

Just for fun

A farmer had 13 boards of equal length. He made 6 pigpens.⟶



He took one board away and then made 6 pigpens with 12 boards. The new pens were all the same size and shape, but differed in size and shape from the old pens.

Use toothpicks and arrange them to show how the farmer built his new pens.

UNIT 9

Two-figure divisors. Finding quotient figures by subtraction; by using helping tables; by estimating (Hint System)

Dividing by tens

Miss Frost's pupils have just opened a pet show to earn money for the Children's Hospital.

Diana made the above chart to show how many tickets the pupils sell and how much money they take in.

1. The chart shows that each ticket sells for _?_.

So far they have sold _?_ tickets and collected _?_¢.

2. How much will they have collected after they have sold 8 tickets? 9 tickets? 10? 11? 12? 13? 20?

3. Don said, "You did a lot of extra work on that chart, Diana.

"You could have just shown how much money we have collected. Then anybody can figure out how many tickets we have sold." Explain what Don means.

4. 70¢ is 7 dimes; so when they have 70¢, they have sold _?_ tickets.

5. Cover the "Tickets Sold" row on the chart. Tell how Don would find how many tickets had been sold after 20¢ had been collected; 30¢; 60¢; 90¢; $1.00; $1.20.

To the Teacher: See Note 5 on page 310.

6. Jim said, "Don is right, but I think of it this way: If one ticket costs 10¢, then for 70¢ we sell 70¢ ÷ 10¢, or ? tickets. you could write the division like this:"

$$\begin{array}{r} 7 \\ 10\overline{)70} \end{array}$$

What does each of these divisions tell about the chart?

7. $\begin{array}{r} 2 \\ 10\overline{)20} \end{array}$ $\quad \begin{array}{r} 3 \\ 10\overline{)30} \end{array}$ $\quad \begin{array}{r} 4 \\ 10\overline{)40} \end{array}$

8. $\begin{array}{r} 5 \\ 10\overline{)50} \end{array}$ $\quad \begin{array}{r} 6 \\ 10\overline{)60} \end{array}$ $\quad \begin{array}{r} 9 \\ 10\overline{)90} \end{array}$

9. Arrange 40 counters in piles of 10. Your counters show there are ? 10's in ?. You can write this in two ways:

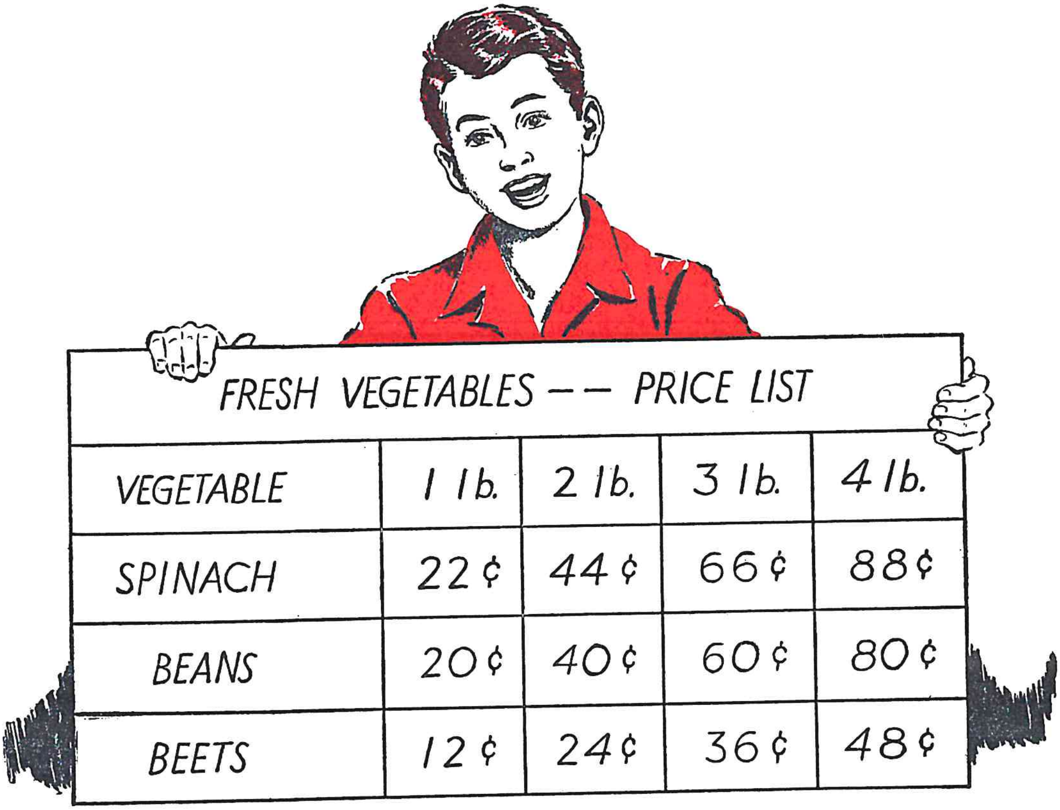
$$40 \div 10 = 4 \qquad \begin{array}{r} 4 \\ 10\overline{)40} \end{array}$$

10. Now arrange the 40 counters in piles of 20. How many piles do you have? In two ways write what the counters show.

11. How many movie tickets at 20¢ each can you buy for 40¢? for 60¢? for 80¢? for $1.00? Write in two ways a division that shows how to find each answer.

12. How many 30-cent "funny books" can you buy for 60¢? 90¢? Write each division in two ways.

13. Jim had 60¢. How many 10-cent magic tricks can he buy? How many 20-cent tricks? How many 30-cent tricks? Write each division in two ways.



FRESH VEGETABLES -- PRICE LIST				
VEGETABLE	1 lb.	2 lb.	3 lb.	4 lb.
SPINACH	22¢	44¢	66¢	88¢
BEANS	20¢	40¢	60¢	80¢
BEETS	12¢	24¢	36¢	48¢

Joe's price list

One day Joe brought to school the price chart he uses to help find how much to charge for things he sells in Mr. Ray's grocery store.

Use Joe's chart to answer these questions:

1. How much does Joe charge for 1 lb. of spinach? 1 lb. of beans? 1 lb. of beets?

2. How much does 2 pounds of spinach cost? 3 lb.? 4 lb.?

3. What is the selling price of 4 lb. of beans? 2 lb.? 3 lb.?

4. What will $2\frac{1}{2}$ pounds of spinach cost? $1\frac{1}{2}$ lb. of beets?

5. How many pounds of beans can you buy for 60¢? 80¢?

6. What is the largest whole number of pounds of spinach that you can buy for $1.00? How much change will you receive?

7. Seventy-five cents will buy how many whole pounds of beans? There will be ___?___¢ left.

8. A half dollar will buy how many pounds of beets?

Number discoveries from Joe's price list

1. After looking at Joe's chart on page 74, the class began to make some number discoveries. Betty said, "The first row of numbers is like a multiplication table of 22's. The table goes like this":

$$\begin{array}{l} 1 \times 22 = 22 \\ 2 \times 22 = 44 \\ 3 \times 22 = 66 \\ 4 \times 22 = 88 \end{array}$$

Write the two other multiplication tables the chart teaches.

2. Alice made a different discovery. She said, "When you look to see how many pounds of spinach you can get for 88¢, you are looking up the answer to a division example.

"The numbers in the pounds row will tell you how many 22's there are in 88, or in 44, or in __?__, or in __?__."

3. Here are the division examples the class found in the first row of Joe's chart. They missed one. Find it. Write it.

$$\begin{array}{r} 1 \\ 22\overline{)22} \end{array} \qquad \begin{array}{r} 2 \\ 22\overline{)44} \end{array} \qquad \begin{array}{r} 4 \\ 22\overline{)88} \end{array}$$

In each of the divisions above, the quotient figure was placed over the ones figure in the dividend. Why?

4. Write four division examples you find in the second row of Joe's chart; in the third row.

5. Ted wrote a division for each multiplication in Joe's chart. Here is one of Ted's pairs:

$$\begin{array}{r} 22 \\ \times\ 2 \\ \hline 44 \end{array} \qquad \begin{array}{r} 2 \\ 22\overline{)44} \end{array}$$

How many other pairs of multiplication and division examples can you find in Joe's chart?

6. Have you noticed that the divisions you have been writing have two-figure divisors?

See if you can write ten division examples with two-figure divisors. Choose examples for which you can find the right quotients.

These two divisions will help you get started:

- $20\overline{)40}$ The quotient is 2 because there are two 20's in 40.
- $40\overline{)80}$ The quotient is __?__ because there are __?__ 40's in __?__.

7. Make a chart to show:

- how many pounds of spinach at 23¢ a pound you can get for 23¢; for 46¢; for 69¢; for 92¢.
- how many pounds of beans at 21¢ a pound you can get for 21¢; for 42¢; for 63¢; for 84¢.

Using a table to make number discoveries

The children in Miss Blake's room keep notebooks in which they write the new words they learn to use. Each page in the notebooks holds exactly twenty-one words.

Here is a multiplication table with facts about 21. Use it to answer the questions below about the notebooks.

1	× 21	=	21
2	× 21	=	42
3	× 21	=	63
4	× 21	=	84
5	× 21	=	105
6	× 21	=	126

1. Which fact tells how many words there would be on 6 pages? on 3 pages?

2. There is no fact to tell how many words there would be on 7 pages. Can you write the fact about seven 21's? eight 21's? nine 21's?

3. Which fact tells us how many pages of 21 words it will take to write 84 words? 126 words? 42 words? 105 words?

4. Show how you could use one of the facts in the table above to obtain the quotient to this division: $21\overline{)63}$.

What does the quotient to this example tell about the notebooks?

5. Copy the division in Ex. 4 and write the quotient in the correct place.

6. What does this example tell about the notebooks?

$$\begin{array}{r} 9 \\ 21\overline{)189} \end{array}$$

How can you tell whether the quotient is correct?

7. What does this example ask about the notebooks?

$$\begin{array}{r} ? \\ 21\overline{)84} \end{array}$$

Use the table to help you find the quotient.

8. Nancy wants to know how many pages it will take to write 130 words. She has done part of the division. Copy and finish it.

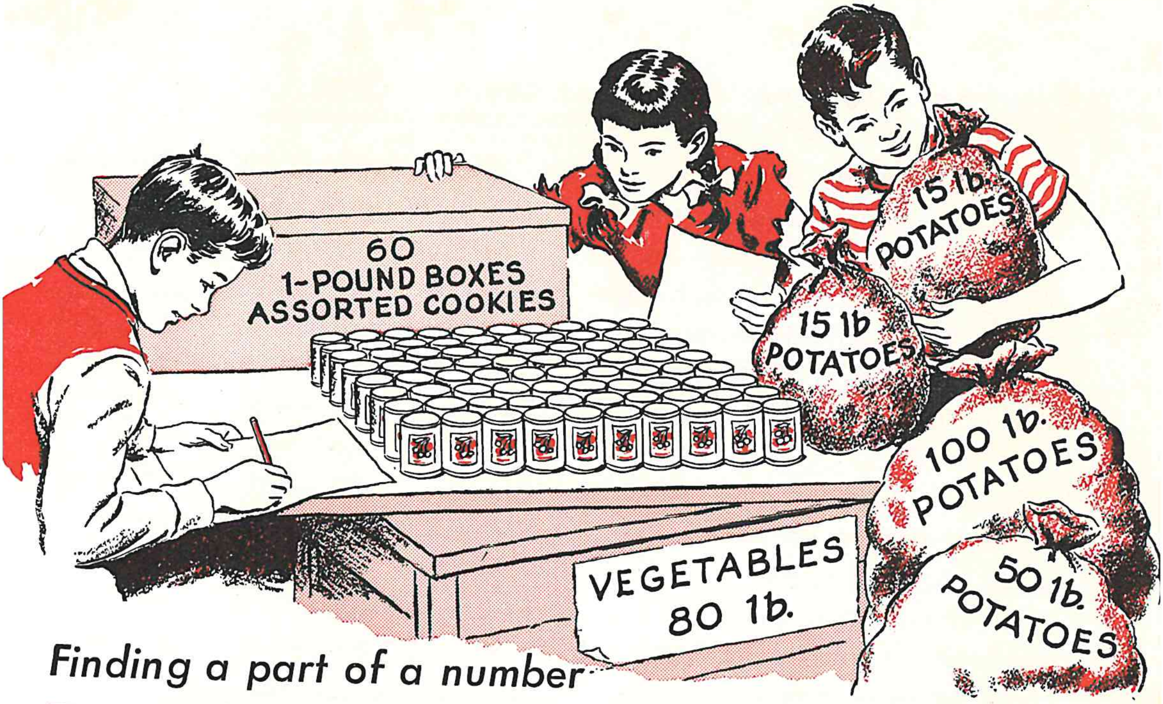
$$\begin{array}{r} 6 \\ 21\overline{)130} \end{array}$$

9. Your division in Ex. 8 shows that to write 130 words Nancy will fill _?_ pages in her notebook, and there will be _?_ words on the next page.

10. Use the table to find how many whole pages Bill would need to write 120 words.

How many words would he write on the next page?

11. Write a division to show how to find the answers in Ex. 10.



Finding a part of a number

The Jefferson School bought food for 20 Thanksgiving baskets. The picture shows they bought ? cans of fruit, ? lb. of potatoes, ? lb. of cookies, and ? lb. of vegetables.

They wondered how many cans of fruit they should put in each of the 20 baskets.

① Joe said, "We will have to put $\frac{1}{20}$ of the 80 cans of fruit in each basket. To find $\frac{1}{20}$ of 80, we do this division: $20\overline{)80}$."

② Peter said, "Joe is right. I think of it this way: twenty times *the number of cans we put in each basket* equals 80. I write $20 \times N = 80$.

"To find what number N stands for, we do this division: $20\overline{)80}$."

1. Write a division that shows how to find how many pounds of potatoes to put in each basket; how many pounds of cookies; how many pounds of vegetables.

2. Now use this table to find the quotient in each of the divisions you wrote in Ex. 1. Work the divisions.

$20 \times 1 =$	20
$20 \times 2 =$	40
$20 \times 3 =$	60
$20 \times 4 =$	80
$20 \times 5 =$	100
$20 \times 6 =$	120
$20 \times 7 =$	140
$20 \times 8 =$	160
$20 \times 9 =$	180

3. Your divisions in Ex. 2 show that ? lb. of potatoes should go in each basket; ? lb. of cookies; ? lb. of vegetables; ? cans of fruit.

Finding quotients for two-figure divisors

Linda brought a division example to class. "I want to find out how many 31's there are in 97," she said, "but I don't know how to find the quotient number."

She wrote this division on the board: $31\overline{)97}$.

1. Jack thought the number of 31's in 97 could be found by starting with 97 and subtracting 31 as many times as possible. He did the subtractions: ⟶

$$\begin{array}{r} 97 \\ -\ 31\ \surd \\ \hline 66 \\ -\ 31\ \surd \\ \hline 35 \\ -\ 31\ \surd \\ \hline 4 \end{array}$$

"In 97 there are __?__ 31's and 4 left over," he said.

2. Linda then checked Jack's work by doing this addition: ⟶

$$\begin{array}{r} 31 \\ 31 \\ 31 \\ +\ 4 \\ \hline 97 \end{array}$$

Was Jack's answer correct?

3. Bob found how many 31's there were in 97 by making this helping table: ⟶

1	×	31	=	31
2	×	31	=	62
3	×	31	=	93
4	×	31	=	124

The table shows that in 93 there are __?__ 31's, and that in 124 there are __?__ 31's. In 97 there are __?__ 31's with a remainder of __?__.

4. Linda found the number of 31's in 97 by dividing:

▶ She knew from Jack's and Bob's work that the quotient figure was 3, so she wrote the 3 in its place: ⟶

$$\begin{array}{r} 3\ \text{r}4 \\ 31\overline{)97} \\ 93 \\ \hline 4 \end{array}$$

▶ Then she multiplied: $3 \times 31 = 93$. She wrote the 93 under the 97.

▶ Next she subtracted to see how much was left over.

$97 - 93$ leaves 4. She wrote the 4 in the ones column.

▶ Finally, Linda looked to see if the remainder, 4, was less than the divisor, 31.

If the remainder had been *more than* the divisor, Linda would have known that her quotient figure was too small. Can you explain how she would have known this?

Four is less than 31; so Linda wrote the remainder in the quotient.

▶ Her division shows there are __?__ 31's in 97 and a remainder of 4. Check this answer.

5. Find how many 31's there are in 128 by subtracting 31 over and over; by using the helping table in Ex. 3; by dividing as in Ex. 4.

Check your answer as Linda checked in Ex. 2.

Using helping tables to find quotient figures

FINDING THE QUOTIENT FIGURE BY SUBTRACTING

$$\begin{array}{r l} 98 & \\ -\ 32 & \surd \\ \hline 66 & \\ -\ 32 & \surd \\ \hline 34 & \\ -\ 32 & \surd \\ \hline 2 & \end{array}$$

FINDING THE QUOTIENT FIGURE BY MAKING A HELPING TABLE

$1 \times 32 = 32$
$2 \times 32 = 64$
$\boxed{3 \times 32 = 96}$
$4 \times 32 = 128$
$5 \times 32 = 160$
$6 \times 32 = 192$
$7 \times 32 = 224$

$$\begin{array}{r} 98 \\ -\ 96 \\ \hline 2 \end{array}$$

Billy wants to find the quotient figure for this division: $32\overline{)98}$

He can find the number of 32's in 98 by *subtracting,* as shown in the first box above, or by *making a helping table,* as shown in the second box.

Each method shows that there are _?_ 32's in 98 and there is a remainder of _?_.

1. Now copy the division, filling in the missing numbers: →

$$\begin{array}{r} ?\ r?\\ 32\overline{)98} \\ ?? \\ \hline ? \end{array}$$

2. Billy wanted to divide 198 by 32. His table of 32's at the top of the page shows that *seven 32's* is *larger* than 198.

It shows that *six 32's* is *smaller* than 198.

Which quotient figure should Billy use, 6 or 7?

3. Just for fun, Billy worked the division twice. One time he used 6 for the quotient figure, and one time he used 7.

How can you tell which division is incorrect?

$$\begin{array}{r} 6\ r6 \\ 32\overline{)198} \\ 192 \\ \hline 6 \end{array} \qquad \begin{array}{r} 7 \\ 32\overline{)198} \\ 224 \\ \hline \end{array}$$

Use the helping table at the top of the page to find the quotient figure in these divisions. Then divide.

4. $32\overline{)47}$ $\quad 32\overline{)100}$ $\quad 32\overline{)200}$

5. $32\overline{)170}$ $\quad 32\overline{)78}$ $\quad 32\overline{)130}$

Make helping tables to find the quotient figures below. Then divide.

6. $33\overline{)70}$ $\quad 20\overline{)83}$ $\quad 31\overline{)132}$

7. $21\overline{)92}$ $\quad 29\overline{)90}$ $\quad 26\overline{)102}$

Finding the quotient by the Hint System

You have learned to find the quotient figure by doing subtractions and by using a helping table.

Now you are ready to learn how to find the quotient figure by a short cut. Look at this division example: →

$$\boxed{23\overline{)69}}$$

You do not have to subtract 23 over and over, or make a helping table. You can get a good ***hint*** of the quotient figure.

Divide the first figure of the dividend, 6, by the first figure of the divisor, 2.

$6 \div 2 = 3$; so there are probably *three* 23's in 69.

$$\boxed{\begin{array}{r} 3 \\ 23\overline{)69} \\ \underline{??} \end{array}}$$

Now try 3 for the quotient figure in $23\overline{)69}$. Complete the division. Does the ***hint*** work?

Tell how the quotient figures were found by the ***Hint System.*** *Then copy and complete the divisions.*

	a	b	c	d
1.	$\begin{array}{r} 2 \\ 43\overline{)90} \end{array}$	$\begin{array}{r} 3 \\ 31\overline{)99} \end{array}$	$\begin{array}{r} 4 \\ 12\overline{)49} \end{array}$	$\begin{array}{r} 2 \\ 41\overline{)95} \end{array}$
2.	$\begin{array}{r} 3 \\ 13\overline{)39} \end{array}$	$\begin{array}{r} 4 \\ 22\overline{)96} \end{array}$	$\begin{array}{r} 2 \\ 32\overline{)69} \end{array}$	$\begin{array}{r} 1 \\ 41\overline{)56} \end{array}$

Sometimes the ***Hint System*** may not give you the exact quotient figure, but it usually gives you a close estimate.

Divide and check. Use the ***Hint System*** *to find the quotient figures.*

	a	b	c
3.	$32\overline{)76}$	$33\overline{)68}$	$23\overline{)95}$
4.	$14\overline{)29}$	$11\overline{)45}$	$42\overline{)99}$
5.	$24\overline{)76}$	$31\overline{)63}$	$22\overline{)53}$

6. Find what number N stands for in these:

$N \times 23 = 92$ $\quad$ $4 \times N = 128$

$N \times 13 = 39$ $\quad$ $31 \times N = 93$

7. Stanley needs 72 inches of rope for his tent. How many yards of rope should he buy? (1 yd. = _?_ in.)

8. Susan has 85 cents. How many pounds of date bars at 41 cents a pound can she buy?

9. Harry can get a pencil for 25 soap wrappers. He has 79 wrappers.

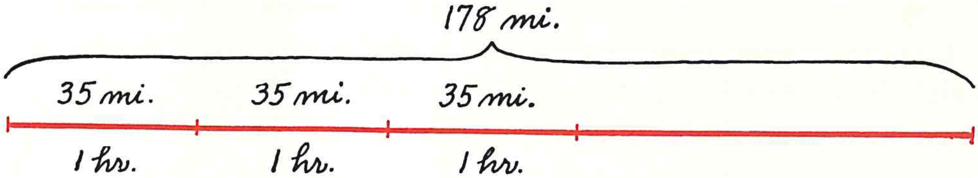
How many pencils can he get?

10. If 12 children share equally 38 shells, how many shells will each get?

How many shells will be left?

11. How many days are there in 72 hours? (24 hours = 1 day.)

Finding quotient figures



Peter knows that his father usually drives about 35 miles an hour. He is wondering how many hours it will take to drive to St. Louis, a distance of 178 miles.

Peter drew the diagram above and thought, "It will take 1 hour for the first 35 miles, 1 more hour for the second 35 miles, and so on.

"It will really take as many hours as there are 35's in 178. I must divide 178 by 35."

To divide 178 by 35:

$$\begin{array}{r} 5\text{ r}3 \\ 35\overline{)178} \\ \underline{175} \\ 3 \end{array}$$

▶ Use the Hint System to find the quotient figure.

Think, "There are probably as many 35's in 178 as there are 3's in 17." Write the 5 in the quotient.

▶ Tell how the division is completed. Write the remainder in the quotient. Check.

Tell how the quotient figures were estimated in these divisions. Then copy and finish each division. Check each answer.

	a	b	c	d	e
1.	$\begin{array}{r} 6 \\ 20\overline{)132} \end{array}$	$\begin{array}{r} 8 \\ 22\overline{)179} \end{array}$	$\begin{array}{r} 5 \\ 23\overline{)116} \end{array}$	$\begin{array}{r} 7 \\ 53\overline{)384} \end{array}$	$\begin{array}{r} 5 \\ 30\overline{)169} \end{array}$
2.	$\begin{array}{r} 3 \\ 41\overline{)135} \end{array}$	$\begin{array}{r} 6 \\ 32\overline{)192} \end{array}$	$\begin{array}{r} 3 \\ 52\overline{)175} \end{array}$	$\begin{array}{r} 5 \\ 23\overline{)118} \end{array}$	$\begin{array}{r} 6 \\ 62\overline{)384} \end{array}$

Divide and check:

3.	$41\overline{)293}$	$43\overline{)172}$	$31\overline{)168}$	$21\overline{)117}$	$32\overline{)267}$
4.	$23\overline{)139}$	$21\overline{)118}$	$44\overline{)276}$	$42\overline{)308}$	$42\overline{)276}$
5.	$33\overline{)169}$	$22\overline{)116}$	$20\overline{)152}$	$22\overline{)178}$	$61\overline{)378}$
6.	$30\overline{)281}$	$31\overline{)189}$	$23\overline{)119}$	$34\overline{)208}$	$53\overline{)384}$
7.	$40\overline{)186}$	$42\overline{)231}$	$45\overline{)145}$	$52\overline{)118}$	$33\overline{)297}$

UNIT 10

Meaning of a mile. Time-rate-distance relationship. Bar graphs. Maintenance

What is a mile?

1. Joyce's front yard is 50 ft. wide. Measure off a distance of 50 ft. on the school playground.

2. The block in which Joyce lives has 10 houses. Each house is built on a lot 50 ft. wide.

How many feet are there in the block?

3. Joyce walks 5 blocks to school. Counting 500 ft. to a block, 5 blocks is a distance of _?_ ft.

4. How many feet does Joyce walk to school and back again? This distance is about a mile.

LEARN THIS 5280 feet = 1 mile

5. Name a place about a mile from your school. Walk the mile. See how long it takes you.

Most boys and girls can walk a mile in about 15 minutes.

6. Keep in mind the mile you walk as a good *mile measure.*

How can you use your mile measure to help you tell how far apart other places are?

7. Do you go to school by bus? About how many miles a day do you ride?

8. Dan walked from his home to school. It took him $\frac{1}{2}$ hour.

He said, "The school is about 2 miles from our house." How did he know that?

9. It takes Tom about 8 minutes to walk to school. He said, "I must live about a half mile from school." How did he know that?

10. Some Boy Scouts went on a hike. They walked for a half hour, rested, then walked on for another half hour.

Can you figure out about how far they walked that day? Don't forget they had to walk back home.

11. Ask somebody in your class who has a bicycle to ride a mile. How long does it take?

How long would it take to ride $\frac{1}{2}$ mile? 2 miles? 3 miles?

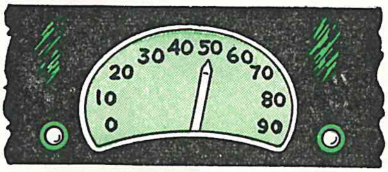
12. Ask someone in your class to roller skate a mile. How long does it take?

How long would it take to skate $\frac{1}{2}$ mile? 2 miles? 3 miles?

13. What needs does a person traveling in an automobile have for understanding the meaning of a mile?

Finding rate of travel

1. George likes to watch the speedometer when he rides in the auto with his father.



When the hand points to 20, George knows they are traveling at a *rate* of 20 miles an hour.

When the hand points to 50, George says, "Father, remember the speed limit." What do you think he means?

2. George noticed one day that it took 2 hours to drive 84 miles.

He remarked to his father, "We have been traveling at an *average* rate of 42 miles an hour." How did he get the "42"?

Do you think the speedometer hand pointed to 42 all the time they were traveling?

3. One day when he was on a 4-hour trip, George made this record showing the distance he traveled during each of the four hours.

1st hr.	38 mi.
2nd hr.	42 mi.
3rd hr.	40 mi.
4th hr.	44 mi.

The total distance traveled during the four hours was ? miles.

4. George thought, "If we travel 164 miles in 4 hours, then our average rate of speed is $\frac{1}{4}$ of 164 miles, or ? miles an hour.

"That is sensible, because my record (Ex. 3) shows that we traveled less than 41 miles an hour during ? of the hours, and more than 41 miles an hour during ? of the hours."

5. Here is a record of another trip that George took. The total distance traveled was ? miles; the total time was ? hours.

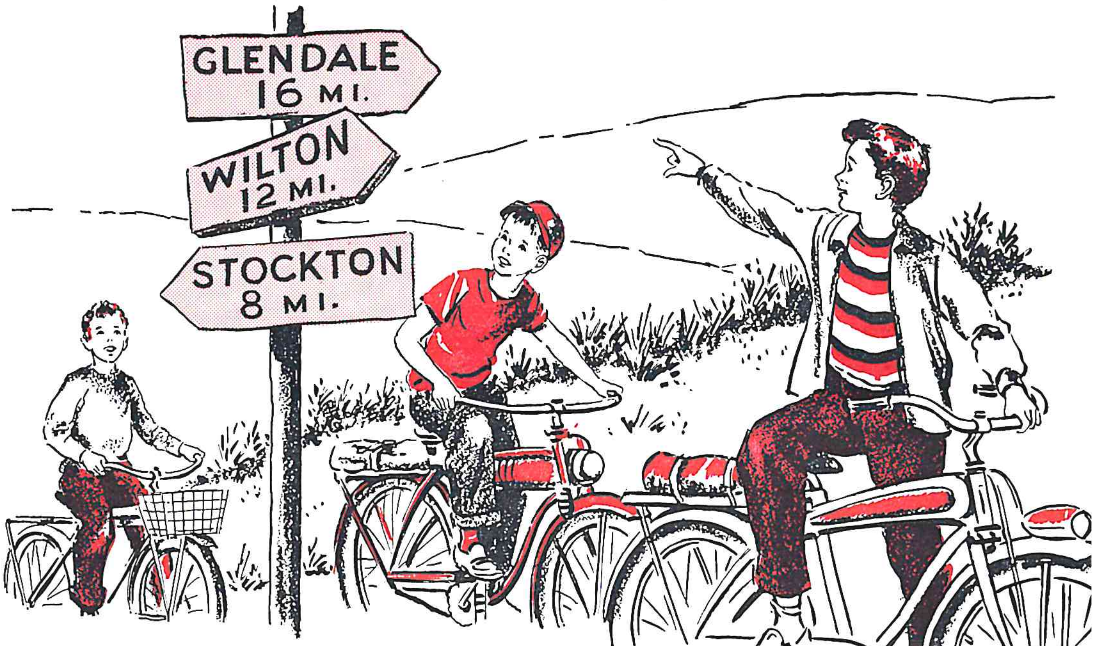
1st hr.	36 mi.
2nd hr.	40 mi.
3rd hr.	12 mi.
4th hr.	48 mi.
5th hr.	44 mi.

The average rate of speed was $\frac{1}{5}$ of 180 miles, or ? miles an hour.

6. Look at George's table in Ex. 5. During which hours did they travel faster than 36 miles an hour, their average rate of speed? slower than their average rate of speed? at their average rate of speed?

7. What facts must you know to find an average rate of speed?

8. Can you make a rule for finding an average rate of speed?



Finding distance traveled

1. These boys ride at an average rate of 8 miles an hour.

Use the diagram below to prove that they can ride over to Glendale in 2 hours.

1st hr.	2nd hr.	3rd hr.
8 mi.	8 mi.	8 mi.

2. The diagram shows that in 3 hours the boys would travel a distance of _?_ miles.

3. What distance would the boys (Ex. 1) travel in $2\frac{1}{2}$ hr.? in $1\frac{1}{2}$ hr.? in 60 minutes?

4. Suppose a plane flies at an average rate of 260 miles an hour. Can it fly from Chicago to New York (748 mi.) in less than 3 hours?

5. Dick's father drove his jeep at an average rate of 27 miles an hour.

In 4 hours he traveled _?_ mi.

In 8 hours he traveled _?_ mi.

Draw diagrams to prove your answers.

6. Some Sea Scouts rode in a speedboat at an average rate of 38 miles an hour.

In 6 hours they rode _?_ miles.

7. Find the distance when the time is 12 hours and the average rate is 50 miles an hour.

8. How do you find the *distance traveled* when you know the *time* and the *rate?*

Finding travel time

Draw diagrams to help you.

1. If Don travels 8 miles an hour on his bicycle, how many hours will he need to travel 16 miles? 24 miles? 32 miles?

2. If a train travels at an average rate of 60 miles an hour, how many hours will it take to travel 120 miles? 180 miles? 540 miles?

3. If a bus travels at an average rate of 40 miles an hour, how many hours would it take the bus to travel 80 miles? 200 miles? 320 miles?

4. How do you find the *time* when you know the *rate* and the *distance?*

5. Find the missing numbers in this table.

TIME	AVERAGE RATE (MILES AN HOUR)	DISTANCE
10 hr.	42	? mi.
5 hr.	?	400 mi.
?	25	75 mi.
$2\frac{1}{2}$ hr.	38	? mi.
8 hr.	$12\frac{1}{2}$	? mi.
6 hr.	25	?
20 hr.	?	180 mi.
?	30	60 mi.
$4\frac{1}{2}$ hr.	50	?
12 hr.	?	48 mi.

Using short cuts

1. Show how each statement below works in multiplying 24; 38.

- To multiply a whole number by 10, put a zero after the number.
- To multiply a whole number by 100, put 2 zeros after the number.
- To multiply a whole number by 1000, put 3 zeros after the number.

Use the short cuts above to help answer these questions:

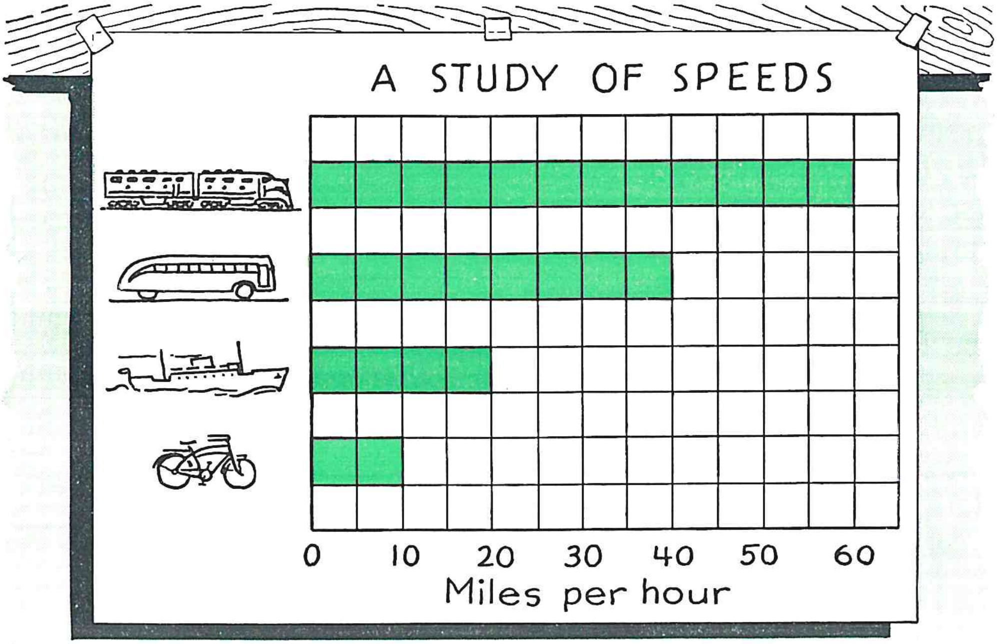
2. Tell which is more:

10×35, or 355	10×54, or 5422
10×41, or 399	100×35, or 3473
10×88, or 805	1000×8, or 8700
10×72, or 700	100×63, or 6500
10×87, or 900	100×42, or 3990

3. Is 562 about 10×56 or about 100×56?

4. Is 1220 about 20×41 or about 30×41?

5. Is the number of 32's in 1000 about 30 or about 300?



How fast do they go?

Peter made this ***bar graph*** to compare the average speeds of a fast train, a bus, a ship, and a bicycle.

The numbers along the bottom of the graph show the speed, or rate of travel. These numbers are called the ***scale*** of the graph. The scale starts with zero.

Each line marks off a distance that stands for 5 miles an hour.

1. The bar showing the speed of the train ends at the line marked 60. This means that the average rate of travel of the train is _?_ miles an hour.

2. The average rate of travel of the bus is _?_ miles an hour.

3. How many miles an hour does the ship travel?

4. How many miles an hour does the bicycle rider travel?

5. Peter said, "I wish I could show the average speed of a plane on my graph. The graph would have to be too wide to show an average speed of 240 miles an hour." The "airplane" bar would have to be _?_ times as long as the "bicycle" bar.

Arithmetic roundup

Oral review

1. Read these numbers:

a	*b*	*c*
268,496	406,823	321,067
8,000,000	7,004,040	1,002,450
2,406,500	8,730,054	9,670,184
5,400,560	9,909,090	4,060,404
6,603,457	9,321,001	2,808,088

2. 9 more than 6 is ?.

3. The product of 8 and 9 is ?.

4. 19 increased by 9 is ?.

5. 19 is ? more than 12.

6. The number that is 25 larger than 17 is ?.

7. The difference between 33 and 28 is ?.

8. In the number 5,642, if you change the 6 to a zero the number becomes ? smaller.

9. 2:35 P.M. is the same as ? minutes of ?.

10. From 10:20 A.M. to 11:05 A.M. is ? minutes.

Written review

1. 55 + 148 + 19

2. \$16.45 + \$24.06

3. 195 − 38

4. 1006 − 47

5. 87 × 56

6. 60 × 694

7. 69 ÷ 23

8. $13\overline{)29}$

9. $62\overline{)477}$

10. Sue put \$5.50 in the bank in September, \$3.75 in October, and \$.65 in November. In the three months she deposited ?.

11. Sue (Ex. 10) is going to take \$6.95 from her bank account for a pair of skates. How much will she have left in the bank?

12. At 32 cents a pound, how many pounds of cookies can Ruth buy for 75 cents?

13. How many cards 3 in. long can be cut from a 38-inch strip of cardboard?

14. Write the largest 6-figure number; the smallest 7-figure number.

15. Alice and Jane paddle their canoe at an average rate of 4 miles an hour. At that rate, to paddle a distance of 12 miles would take them ? hours.

UNIT 11

Meaning of two-figure quotients. Practice in estimating and dividing to find two-figure quotients

Estimating two-figure quotients

The 303 pupils in Wilson School are going by bus to see a Safety First movie. Each bus carries 30 pupils. Joan figured out how many buses will be needed:

▶ She said, "We have to find the number of 30's in 303." She wrote:⟶

$$30\overline{)303}$$

▶ Joan compared the divisor, 30, and dividend, 303. She saw that 303 was much larger than 30; so she knew that the quotient would be much more than 2 or 3.

$$\begin{array}{r} 10 \\ 30\overline{)303} \\ \underline{300} \\ 3 \end{array}$$

▶ Joan remembered the short cut for multiplying by 10 and thought she would use it to see whether the quotient would be more or less than 10.

$10 \times 30 = 300$; $303 - 300$ gives a remainder of 3. Since the remainder was less than 30, Joan knew 10 was the right quotient.

▶ Joan did the division shown in the box. Explain it.

▶ Joan said, "If 3 children are absent the day we go, then 10 buses will be enough." Is she right?

1. If the dividend is less than 10 times the divisor, the quotient will be a one-figure number.

Is the quotient in $23\overline{)212}$ as much as 10? ($10 \times 23 =$?) Then how many figures are there in the quotient?

2. Can you make up a rule to help you tell when a quotient will be a two-figure number?

Which of these have one-figure quotients? two-figure quotients?

	a	*b*	*c*	*d*	*e*
3.	$15\overline{)160}$	$45\overline{)112}$	$23\overline{)115}$	$26\overline{)257}$	$28\overline{)283}$
4.	$50\overline{)495}$	$24\overline{)250}$	$60\overline{)660}$	$24\overline{)200}$	$30\overline{)600}$

In which of these divisions is the dividend about 10 times the divisor? about 20 times the divisor? about 30 times the divisor? Use the Hint System to help you.

5.	$21\overline{)426}$	$39\overline{)401}$	$41\overline{)835}$	$32\overline{)645}$	$23\overline{)697}$
6.	$46\overline{)482}$	$12\overline{)250}$	$24\overline{)732}$	$13\overline{)270}$	$32\overline{)965}$

Two-figure quotients

Mr. Davis, the principal of Webster School, needs 288 pencils. There are 24 pencils in each package. How many packages should he get from the supply room?

You have to find how many groups of 24 pencils there are in 288. You do this division: $24\overline{)288}$.

▶ Think, "There are at least ten 24's in 288 because $10 \times 24 = 240$; 288 is more than 240. So there will be a 2-figure quotient." Why?

▶ If there is a 2-figure quotient, one figure will be in tens place in the quotient and the other will be in ones place. Why?

The check marks in Box A show where the quotient figures will be written.

A

$$\begin{array}{r} \surd\surd \\ 24\overline{)288} \end{array}$$

▶ Think, "How many 24's in 288? Ten." Instead of writing the whole 10 in the quotient, write just a 1 in tens place. (Does 1 written in tens place mean ten?)

▶ Explain the division as far as it is worked in Box B.

B

$$\begin{array}{r} 1\surd \\ 24\overline{)288} \\ \underline{240} \\ 48 \end{array}$$

▶ Think, "How many 24's in 48? Two." Now write the 2 in ones place. Tell how to finish the division.

▶ The division in Box C shows there are _?_ 24's in 288. Prove that 12 is the correct answer.

C

$$\begin{array}{r} 12 \\ 24\overline{)288} \\ \underline{240} \\ 48 \\ \underline{48} \end{array}$$

1. In the division in Box C find the missing numbers for this story about Mr. Davis' pencils.

Mr. Davis first picked up ten packages of pencils, or _?_ pencils. How does the division show this?

That wasn't enough. He needed _?_ more pencils. So he got _?_ more packages of pencils.

That gave him the _?_ more pencils he needed. In all, he got _?_ packages of pencils.

Show that when Mr. Davis got 12 packages of pencils, with 24 pencils in a package, he got 288 pencils.

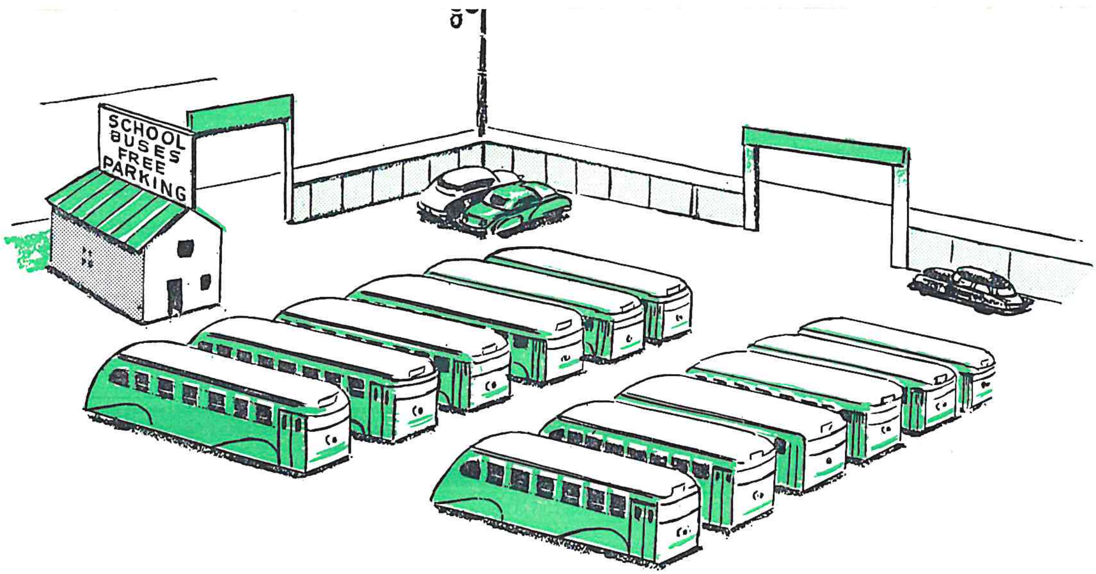
Explain each of these divisions:

2. $$\begin{array}{r} 13 \\ 32\overline{)416} \\ \underline{320} \\ 96 \\ \underline{96} \end{array}$$

3. $$\begin{array}{r} 12 \\ 42\overline{)504} \\ \underline{420} \\ 84 \\ \underline{84} \end{array}$$

4. $$\begin{array}{r} 14 \text{ r}3 \\ 23\overline{)325} \\ \underline{230} \\ 95 \\ \underline{92} \\ 3 \end{array}$$

5. $$\begin{array}{r} 12 \text{ r}8 \\ 31\overline{)380} \\ \underline{310} \\ 70 \\ \underline{62} \\ 8 \end{array}$$



Two-figure quotients

How many buses, each carrying 32 children, are needed to take 384 children to a park? To find out, you have to divide _?_ by _?_.

▶ In the division $32\overline{)384}$, a quick estimate shows that the quotient is surely more than 10 because $10 \times 32 = 320$.

384 is more than 320; so there will be a two-figure quotient. Why?

▶ If there is a two-figure quotient, one figure will be in the tens place in the quotient and the other will be in the ones place. Why?

The check marks in Box A show where the quotient figures will be written.

▶ Think how many 32's there are in 384. There are 10.

A

$$\begin{array}{r} \checkmark\checkmark \\ 32\overline{)384} \end{array}$$

Instead of writing the whole 10 in the quotient, write just a 1 in the tens place.

(Does 1 written in tens place mean ten?)

▶ Explain the division as far as it is worked in Box B.

B

$$\begin{array}{r} 1\checkmark \\ 32\overline{)384} \\ \underline{320} \\ 64 \end{array}$$

▶ Think how many 32's there are in 64: two. Write the 2 in the ones place.

Tell how the division is finished in Box C.

C

$$\begin{array}{r} 12 \\ 32\overline{)384} \\ \underline{320} \\ 64 \\ \underline{64} \end{array}$$

▶ The division in Box C shows there are _?_ 32's in 384. It shows that _?_ buses will be needed.

Prove that 12 is the correct answer.

Two-figure quotients

1. The boxes below show the steps in dividing 299 by 23. See if you can explain what has been done in each step.

A	B	C	D	E	F
√√	1√	1√	1√	13	13
$23\overline{)299}$	$23\overline{)299}$	$23\overline{)299}$	$23\overline{)299}$	$23\overline{)299}$	$23\overline{)299}$
		$\underline{230}$	$\underline{230}$	$\underline{230}$	$\underline{230}$
			69	69	69
					$\underline{69}$

2. Explain how each division is done:

a	*b*	*c*	*d*	*e*
13	12 r4	13 r6	13	11 r7
$32\overline{)416}$	$43\overline{)520}$	$23\overline{)305}$	$13\overline{)169}$	$41\overline{)458}$
$\underline{320}$	$\underline{430}$	$\underline{230}$	$\underline{130}$	$\underline{410}$
96	90	75	39	48
$\underline{96}$	$\underline{86}$	$\underline{69}$	$\underline{39}$	$\underline{41}$
	4	6		7

3. Work and check each of these divisions:

$34\overline{)408}$ $\quad 42\overline{)504}$ $\quad 24\overline{)288}$ $\quad 14\overline{)168}$ $\quad 31\overline{)379}$

In which of these is the quotient about 10? about 20? 30? 40? How can you tell? Does the Hint System help you?

4. $24\overline{)289}$ $\quad 12\overline{)396}$ $\quad 23\overline{)969}$ $\quad 32\overline{)736}$ $\quad 42\overline{)890}$

5. $34\overline{)719}$ $\quad 25\overline{)575}$ $\quad 31\overline{)992}$ $\quad 25\overline{)787}$ $\quad 33\overline{)759}$

6. In each division in Exs. 4–5, tell what figure you should write in the tens place of the quotient.

7. A 2 in tens place stands for 20. What number does 3 in tens place stand for? 4 in tens place?

8. In Exs. 4–5 copy the examples, divide, and check.

9. 156 = __?__ dozen.

10. 252 in. = __?__ ft.

11. 575 cents = __?__ quarters.

Practice in dividing

Work Ex. 1. Then compare your work with Ex. 1 at the bottom of the page. Do the same for the other examples.

1. $32\overline{)704}$ **2.** $22\overline{)682}$ **3.** $12\overline{)396}$ **4.** $20\overline{)840}$

5. $31\overline{)354}$ **6.** $21\overline{)684}$ **7.** $23\overline{)484}$ **8.** $40\overline{)842}$

9. $41\overline{)451}$ **10.** $32\overline{)672}$ **11.** $33\overline{)396}$ **12.** $30\overline{)360}$

13. $42\overline{)895}$ **14.** $31\overline{)686}$ **15.** $21\overline{)486}$ **16.** $11\overline{)345}$

These examples are for checking your work above:

1.
$$\begin{array}{r} 22 \\ 32\overline{)704} \\ \underline{640} \\ 64 \\ \underline{64} \end{array}$$

2.
$$\begin{array}{r} 31 \\ 22\overline{)682} \\ \underline{660} \\ 22 \\ \underline{22} \end{array}$$

3.
$$\begin{array}{r} 33 \\ 12\overline{)396} \\ \underline{360} \\ 36 \\ \underline{36} \end{array}$$

4.
$$\begin{array}{r} 42 \\ 20\overline{)840} \\ \underline{800} \\ 40 \\ \underline{40} \end{array}$$

5.
$$\begin{array}{r} 11 \text{ r13} \\ 31\overline{)354} \\ \underline{310} \\ 44 \\ \underline{31} \\ 13 \end{array}$$

6.
$$\begin{array}{r} 32 \text{ r12} \\ 21\overline{)684} \\ \underline{630} \\ 54 \\ \underline{42} \\ 12 \end{array}$$

7.
$$\begin{array}{r} 21 \text{ r1} \\ 23\overline{)484} \\ \underline{460} \\ 24 \\ \underline{23} \\ 1 \end{array}$$

8.
$$\begin{array}{r} 21 \text{ r2} \\ 40\overline{)842} \\ \underline{800} \\ 42 \\ \underline{40} \\ 2 \end{array}$$

9.
$$\begin{array}{r} 11 \\ 41\overline{)451} \\ \underline{410} \\ 41 \\ \underline{41} \end{array}$$

10.
$$\begin{array}{r} 21 \\ 32\overline{)672} \\ \underline{640} \\ 32 \\ \underline{32} \end{array}$$

11.
$$\begin{array}{r} 12 \\ 33\overline{)396} \\ \underline{330} \\ 66 \\ \underline{66} \end{array}$$

12.
$$\begin{array}{r} 12 \\ 30\overline{)360} \\ \underline{300} \\ 60 \\ \underline{60} \end{array}$$

13.
$$\begin{array}{r} 21 \text{ r13} \\ 42\overline{)895} \\ \underline{840} \\ 55 \\ \underline{42} \\ 13 \end{array}$$

14.
$$\begin{array}{r} 22 \text{ r4} \\ 31\overline{)686} \\ \underline{620} \\ 66 \\ \underline{62} \\ 4 \end{array}$$

15.
$$\begin{array}{r} 23 \text{ r3} \\ 21\overline{)486} \\ \underline{420} \\ 66 \\ \underline{63} \\ 3 \end{array}$$

16.
$$\begin{array}{r} 31 \text{ r4} \\ 11\overline{)345} \\ \underline{330} \\ 15 \\ \underline{11} \\ 4 \end{array}$$

Using division

1. Miss Carter's class has gilded 300 pine cones to hang on Christmas trees. They need a hook to hang each cone.

Christmas-tree hooks come 75 to the box. How many boxes of hooks should they buy for their 300 cones?

2. Jack has saved the seeds from his prize-winning squash. He finds that he has 289. If he puts 20 seeds in a package, how many packages will he have?

3. If Jack (Ex. 2) sells the seeds at 5¢ a package, how much will he get for them?

4. Betsy has counted the sweet-pea seeds she has saved from her flower garden. She has 364.

If she puts 30 seeds in each package, how many packages will she have?

5. At 5¢ a package, how much will Betsy (Ex. 4) get for her sweet-pea seeds?

Divide and check:

	a	b	c	d	e
6.	$21\overline{)675}$	$31\overline{)696}$	$41\overline{)495}$	$21\overline{)488}$	$32\overline{)739}$
7.	$17\overline{)189}$	$21\overline{)887}$	$22\overline{)248}$	$23\overline{)487}$	$21\overline{)685}$
8.	$31\overline{)993}$	$31\overline{)658}$	$13\overline{)274}$	$21\overline{)895}$	$53\overline{)589}$
9.	$32\overline{)681}$	$32\overline{)704}$	$13\overline{)169}$	$21\overline{)867}$	$14\overline{)169}$
10.	$33\overline{)693}$	$41\overline{)476}$	$21\overline{)441}$	$22\overline{)286}$	$42\overline{)887}$
11.	$21\overline{)496}$	$61\overline{)693}$	$42\overline{)468}$	$24\overline{)513}$	$51\overline{)561}$
12.	$51\overline{)573}$	$62\overline{)684}$	$31\overline{)684}$	$41\overline{)884}$	$21\overline{)467}$

Find the missing number in each of these:

13.	$21 \times N = 861$	$N \times 21 = 903$	$N \times 41 = 492$
14.	$N \times 21 = 504$	$36 \times N = 756$	$N \times 24 = 768$

Finding missing numbers

What are the missing numbers below? Tell how you find each.

	a	*b*
1.	$4 \times N = 20$	$N \times 8 = 32$
2.	$9 \times N = 63$	$5 \times N = 45$
3.	$7 \times N = 35$	$9 \times N = 54$
4.	$N \times 8 = 48$	$7 \times N = 49$
5.	$N \times 7 = 49$	$N \times 8 = 56$
6.	$9 \times N = 72$	$N \times 8 = 64$

7. Harry is earning money to buy a bicycle that costs \$36. He earns and saves \$3 a week. How many weeks must he work in order to earn \$36?

Think, "*Some number of weeks* times \$3 equals \$36. $N \times \$3 = \$36$. To find the missing number, I must divide _?_ by _?_."

8. When Edward was at camp, his mother sent him a box of 48 cookies. The 8 boys in Edward's tent shared the cookies equally. How many cookies did each boy get?

Think this way: "8 times *some number of cookies* equals 48 cookies. $8 \times N = 48$. To find the missing number, I must _?_."

Tell what you think as you solve each of these problems:

9. How many pages of his new picture album will Jim use if he has 120 snapshots and arranges them 6 on a page?

10. Material for cooking aprons for 4 girls costs \$2.00. What is each girl's share of the cost?

11. At a carnival, Sue sold ice-cream cones for 5 cents each. When she had taken in 45 cents, how many cones had she sold?

12. Louise is 10 years old. Her little brother is 2 years old. Louise is how many times as old as her brother?

Can you compare their ages in another way?

13. If you divide 54 marbles equally among 6 boys, how many marbles will each boy get?

14. Louise needs 36 doughnuts for a party. The doughnuts come 6 in a box. How many boxes should she buy?

15. If 8 girls share equally in making 48 paper hats, each should make _?_ hats.

Choose wisely

In each box below are 4 divisions and 4 answers. (1) Copy a division. (2) Choose the answer you estimate belongs to it. Write that answer beside the division. (3) Work the division to see whether you chose the correct answer.

1. $82\overline{)750}$	12 r9	**5.** $24\overline{)720}$	3	**9.** $21\overline{)489}$	6 r15
2. $43\overline{)525}$	95	**6.** $3\overline{)900}$	33	**10.** $4\overline{)836}$	12
3. $8\overline{)760}$	9 r12	**7.** $92\overline{)276}$	300	**11.** $75\overline{)465}$	209
4. $32\overline{)675}$	21 r3	**8.** $21\overline{)693}$	30	**12.** $14\overline{)168}$	23 r6
13. $42\overline{)898}$	11 r31	**17.** $11\overline{)349}$	9 r3	**21.** $86\overline{)548}$	63
14. $64\overline{)344}$	21 r16	**18.** $7\overline{)602}$	42 r3	**22.** $21\overline{)687}$	30 r2
15. $41\overline{)482}$	63	**19.** $20\overline{)843}$	31 r8	**23.** $9\overline{)567}$	6 r32
16. $6\overline{)378}$	5 r24	**20.** $54\overline{)489}$	86	**24.** $31\overline{)932}$	32 r15

Find the mistake in each example. Then work and check the example correctly.

Jane

$$\begin{array}{r} 6r11 \\ 72\overline{)453} \\ 432 \\ \hline 11 \end{array} \qquad \text{Check} \quad \begin{array}{r} 72 \\ \times 6 \\ \hline 432 \\ +11 \\ \hline 443 \end{array}$$

Peggy

$$\begin{array}{r} 23R1 \\ 21\overline{)507} \\ 420 \\ \hline 67 \\ 66 \\ \hline 1 \end{array} \qquad \text{Check} \quad \begin{array}{r} 23 \\ \times 21 \\ \hline 23 \\ 46 \\ \hline 483 \\ +1 \\ \hline 484 \end{array}$$

Robert

$$\begin{array}{r} 21r5 \\ 31\overline{)654} \\ 620 \\ \hline 34 \\ 31 \\ \hline 5 \end{array} \qquad \text{Check} \quad \begin{array}{r} 21 \\ 31 \\ \hline 21 \\ 63 \\ \hline 651 \\ 5 \\ \hline 656 \end{array}$$

Harry

$$\begin{array}{r} 5 \\ 62\overline{)329} \\ 310 \\ \hline 9 \end{array} \qquad \text{Check} \quad \begin{array}{r} 62 \\ 5 \\ \hline 310 \\ 9 \\ \hline 319 \end{array}$$

Jim

$$\begin{array}{r} 84R6 \\ 8\overline{)678} \\ 640 \\ \hline 38 \\ 32 \\ \hline 6 \end{array} \qquad \text{Check} \quad \begin{array}{r} 84 \\ \times 8 \\ \hline 662 \\ +6 \\ \hline 668 \end{array}$$

Alice

$$\begin{array}{r} 76r5 \\ 6\overline{)455} \\ 420 \\ \hline 35 \\ 30 \\ \hline 5 \end{array} \qquad \text{Check} \quad \begin{array}{r} 76 \\ 6 \\ \hline 456 \\ 5 \\ \hline 461 \end{array}$$

Dividing larger dividends

Always begin a division by estimating the size of the quotient. In doing the division in box A, take these steps:

A

$$52\overline{)1196}$$

▶ *Estimate* the size of the quotient (whether it has 1 figure, 2 figures, 3 figures, and so on):

Think, "Is 1196 more than 10 × 52? Yes.

"Is 1196 more than 100 × 52? No. So the quotient is between 10 and 100. It must be a 2-figure number. Why?" (See Box B.)

B

$$\begin{array}{r} \surd\surd \\ 52\overline{)1196} \end{array}$$

▶ *Divide* to find the tens figure of the quotient.

Think, "119 ÷ 52." (Try 11 ÷ 5 for a hint.)

Write the 2 in tens place (Box C). You know that 2 in tens place means _?_.

▶ *Multiply:* 20 × 52 = 1040. Write the 1040 as shown in Box C.

C

$$\begin{array}{r} 2\,\surd \\ 52\overline{)1196} \\ \underline{1040} \\ 156 \end{array}$$

▶ *Subtract* to find how much of the dividend is still to be divided: 1196 − 1040 = 156.

▶ *Divide* to find the ones figure of the quotient.

Think, "156 ÷ 52". (What will you use for a hint?)

Write the quotient figure 3 in ones place (Box D).

▶ How do you finish the division (Box D)?

▶ *Check:* Quotient × divisor = 23 × 52 = _?_.

D

$$\begin{array}{r} 23 \\ 52\overline{)1196} \\ \underline{1040} \\ 156 \\ \underline{156} \end{array}$$

▶ See if the answer is sensible. Think, "52 is a little more than 50. 1196 is almost 1200. There are 2 fifties in 100. In 1200 there are 12 × 2 fifties, or 24 fifties. So _?_ is a sensible answer."

Copy without the work. Divide. Then compare your work with the book. Were your quotient figures placed correctly?

1. $$\begin{array}{r} 32 \\ 52\overline{)1664} \\ \underline{1560} \\ 104 \\ \underline{104} \end{array}$$

2. $$\begin{array}{r} 42\text{ r}31 \\ 42\overline{)1795} \\ \underline{1680} \\ 115 \\ \underline{84} \\ 31 \end{array}$$

3. $$\begin{array}{r} 31\text{ r}27 \\ 41\overline{)1298} \\ \underline{1230} \\ 68 \\ \underline{41} \\ 27 \end{array}$$

4. $$\begin{array}{r} 21\text{ r}14 \\ 41\overline{)875} \\ \underline{820} \\ 55 \\ \underline{41} \\ 14 \end{array}$$

Practice in dividing

In each division tell the first quotient figure and where it should be placed. Then work and check each example. Show that each answer is sensible.

	a	*b*	*c*	*d*	*e*
1.	$32\overline{)768}$	$21\overline{)567}$	$31\overline{)2387}$	$31\overline{)837}$	$20\overline{)1740}$
2.	$41\overline{)944}$	$31\overline{)299}$	$41\overline{)658}$	$41\overline{)1396}$	$41\overline{)2788}$
3.	$42\overline{)1389}$	$41\overline{)278}$	$51\overline{)3777}$	$51\overline{)4697}$	$30\overline{)2910}$
4.	$51\overline{)3979}$	$51\overline{)285}$	$53\overline{)689}$	$52\overline{)1666}$	$42\overline{)3998}$
5.	$61\overline{)2748}$	$61\overline{)378}$	$71\overline{)2984}$	$62\overline{)1987}$	$34\overline{)2090}$
6.	$59\overline{)1892}$	$60\overline{)3780}$	$42\overline{)3495}$	$30\overline{)2880}$	$40\overline{)3440}$
7.	$50\overline{)2750}$	$65\overline{)2289}$	$40\overline{)2640}$	$36\overline{)1479}$	$53\overline{)3869}$
8.	$21\overline{)672}$	$30\overline{)2670}$	$72\overline{)1597}$	$42\overline{)1386}$	$22\overline{)1394}$

Tell how you estimate the answers to Exs. 9–17. Do not use a pencil.

9. Is the answer to $560 \div 27$ more than 20?

10. Is the answer to $432 \div 72$ a 2-place number?

11. Is the answer to $2880 \div 32$ closer to 10 or to 100?

12. Is 42 a sensible answer to $1386 \div 33$?

13. Are there 6 forties in 240?

14. Which is more: 8×40, or 310?

15. Is $\frac{1}{6}$ of 1248 more than 200?

16. Suppose you already know that $16 \times 25 = 400$; then you know that $400 \div 25 = \underline{\ ?\ }$.

17. If $N \times 32 = 768$, does N stand for some number that is less than 20?

18. This division is partly done. How does the 6 show that it stands for 60?

$$\boxed{\begin{array}{r} 6 \\ 21\overline{)1394} \\ \underline{1260} \end{array}}$$

UNIT 12

Using arithmetic
Problem solving

The school fair

1. At the Jefferson School Fair Peggy dressed as Priscilla, a Pilgrim girl.

To make her blouse, she bought 2 yards of gray cambric at 40 cents a yard. To make a kerchief and apron, she bought a remnant of white goods for 19 cents.

How much did her costume cost?

2. Roger dressed as John Alden, a Pilgrim hero.

For his costume he needed 6 yards of black sateen at 68 cents a yard, and 2 yards of white goods at 16 cents a yard.

What did Roger's costume cost?

3. At Peggy's booth at the fair, grape pop is being sold. Peggy thinks that she might be able to sell 64 glasses of pop.

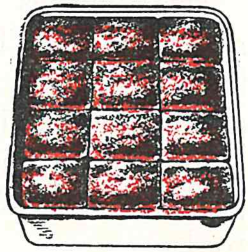
- If Peggy is right, how many quarts of pop will be needed? (4 glasses = 1 quart.)
- How many gallons of pop will be needed?
- At 40 cents a gallon, how much will the pop cost?
- Look at the picture above to see how much Peggy charges for a glass of pop. How much will 64 glasses of pop sell for?
- How much money will the children make on the pop?

4. At Roger's booth, popcorn balls are being sold.

- Corn from 1 ear makes 4 balls. How many ears of corn were needed for 48 balls?
- How much did 12 ears of corn cost if 4 ears cost 5¢?
- 2 oz. of sugar were used to each ear of corn. How much sugar was needed for 12 ears? What did the sugar cost at 10¢ a pound?
- How much did the popcorn balls cost in all?
- How much will the children make on the 48 popcorn balls if they are sold for 3 cents each?

5. The children bought apples at 3 for 5¢ and are selling them at 5¢ each. How much money will they make on the apples?

6. The children can buy one pan of gingerbread for 25 cents.



- If they cut the gingerbread as shown in the picture, how many pieces can they get from a pan?
- How many pans will they need to buy in order to have 48 pieces?
- How much will all that gingerbread cost?
- Will the children make any money if the 48 pieces of gingerbread are sold at 1 cent each? at 2 cents each?
- How much money will they make if the 48 pieces are sold at 3 cents each?

Telling how to solve a problem

The Sullivans want to buy a radio for \$104. They plan to pay for it in a year's time, paying the same amount each week.

How much will they have to pay each week? (1 year = 52 weeks.)

This is how 4 boys solved the problem:

① Bert said, "Each week they should pay $\frac{1}{52}$ of \$104. $\frac{1}{52}$ of \$104 is \$104 ÷ 52, or \$2.

"I can prove my answer is right: 52 × \$2 = \$104."

② Arthur said, "When I don't know how to solve a problem, I first make the problem easier by changing the numbers to smaller numbers.

"That helps me to know whether to add, subtract, multiply, or divide.

"In this problem, if the radio had cost only \$15 and they were going to pay for it in 5 weeks, they would have to pay $\frac{1}{5}$ of \$15 each week. $\frac{1}{5}$ of \$15 is \$15 ÷ 5, or \$3 each week.

"But it really costs \$104, and they are going to pay for it in 52 weeks. So the Sullivans will have to pay $\frac{1}{52}$ of \$104; that is \$104 ÷ 52, or \$2 a week."

③ Jim said, "They will have to pay *some number of dollars* each week. 52 times *some number of dollars* = \$104. 52 × N = \$104.

"To find the missing number, I'll divide \$104 by 52.

"\$104 ÷ 52 = \$2 each week."

④ Jeff said, "104 is a little more than 100. 52 is a little more than 50.

"I know that 100 ÷ 50 = 2; so 104 ÷ 52 is about 2.

"I estimate that they should pay 2 dollars a week."

Each of the boys got the right answer. Do you understand how each one solved the problem? Whose method do you like best?

Tell how you would have solved the problem.

See how many different ways you can think of to do these problems:

1. If Bob saves 25¢ a week, how much will he save in a year?

2. Lou needs 144 inches of rubber hose. How many yards should he buy?

3. If you want to read a 252-page book in a week, how many pages should you read each day, on the average?

4. Find the cost of 9 swimming caps at 25 cents each.

5. Jim has saved $1.25 toward a football that costs $3.50. How much more does he need?

6. Miss Pell bought a 50-foot length of rope. How many 10-foot jumping ropes can she make?

7. Sue's roller skates cost $3.95. Anne's cost $4.39. How much more did Anne pay for her skates than Sue paid for hers?

8. Ned paid $1.36 for 8 stamps from foreign countries. What was the average cost of each stamp?

9. Suits for 9 members of a swimming club cost $13.50. How much did each member's suit cost?

10. Peter would like to have these things for his bicycle: a lock and chain for $1.75, a tire pump for $1.25, and a siren for $1.50. How much money does he need?

11. The materials for making 9 model airplanes cost $3.60. At that rate, what did each airplane cost?

12. An air pilot said that he flew at the rate of 420 miles an hour. How many miles a minute was he flying?

13. "Giant" pencils come in boxes that hold 12 dozen pencils each. How many pencils are there in each box?

14. Jim's family spent $51.99 at a sale of camp supplies. By using these sale prices and the picture below, can you find out what they bought?

Tent	$34.95
Camp stove	$10.95
Folding cot	$ 6.19
Thermos jug (gal. size)	$ 3.15
Camp stool	$ .98
4 aluminum plates	$ 1.19

Dave's test paper

Dave took a test in long division. His test paper is shown below. How many examples are correct?

Arithmetic Dave Burns

1. $$\begin{array}{r} 12 \\ 14\overline{)168} \\ \underline{140} \\ 28 \\ \underline{28} \end{array}$$

Check
$$\begin{array}{r} 12 \\ \underline{\times 14} \\ 48 \\ \underline{12} \\ 168 \end{array}$$

2. $$\begin{array}{r} 45 \\ 32\overline{)1440} \\ \underline{1280} \\ 160 \\ \underline{160} \end{array}$$

Check
$$\begin{array}{r} 45 \\ \underline{\times 32} \\ 90 \\ \underline{135} \\ 1440 \end{array}$$

3. $$\begin{array}{r} 67 \text{ r } 5 \\ 52\overline{)3489} \\ \underline{3120} \\ 369 \\ \underline{364} \\ 5 \end{array}$$

Check
$$\begin{array}{r} 67 \\ \underline{\times 52} \\ 134 \\ \underline{335} \\ 3484 \\ \underline{+5} \\ 3489 \end{array}$$

4. $$\begin{array}{r} 64 \text{ r } 10 \\ 83\overline{)5322} \\ \underline{4980} \\ 342 \\ \underline{332} \\ 10 \end{array}$$

Check
$$\begin{array}{r} 64 \\ \underline{\times 83} \\ 192 \\ \underline{512} \\ 5312 \\ \underline{+10} \\ 5322 \end{array}$$

Work and check these division examples:

	a	*b*	*c*	*d*	*e*
1.	$62\overline{)4779}$	$63\overline{)5799}$	$65\overline{)5265}$	$66\overline{)3564}$	$58\overline{)2499}$
2.	$67\overline{)4154}$	$68\overline{)408}$	$74\overline{)6889}$	$75\overline{)6230}$	$59\overline{)1890}$
3.	$53\overline{)4487}$	$47\overline{)1486}$	$58\overline{)1862}$	$62\overline{)1924}$	$56\overline{)3980}$
4.	$42\overline{)3497}$	$43\overline{)3150}$	$34\overline{)2085}$	$36\overline{)1476}$	$57\overline{)3490}$
5.	$52\overline{)2970}$	$54\overline{)4489}$	$47\overline{)1598}$	$48\overline{)1498}$	$67\overline{)5427}$

Arithmetic roundup

Oral review

Choose the correct answer from those given.

1. Which of these is largest? smallest? (Use a ruler to help.)

$2\frac{1}{2}$ in. $\quad$ $\frac{6}{4}$ in. $\quad$ $\frac{21}{8}$ in. $\quad$ $1\frac{7}{8}$ in.

2. 3:40 P.M. is the same as: $\begin{cases}\text{20 minutes of 3 in the afternoon}\\ \text{20 minutes of 4 in the afternoon}\end{cases}$

3. Six dozen eggs is: 60 eggs $\quad$ 72 eggs $\quad$ 62 eggs

4. 16 qt. equals: 32 gal. $\quad$ 4 gal. $\quad$ 8 gal. $\quad$ 24 gal.

5. 2 divided by 3 is: less than 1 $\quad$ more than 1

6. 1386 ÷ 42 is: more than 10 $\quad$ as much as 100

7. The quotient in 943 ÷ 36 is: a 1-figure number $\quad$ a 2-figure number

8. 1386 ÷ 42 is about: 45 $\quad$ 30 $\quad$ 21

Written review

1. $\begin{array}{r} 36\\ 47\\ 175\\ 86\\ \underline{295} \end{array}$

2. $\begin{array}{r} \$7.55\\ .98\\ 3.04\\ .62\\ \underline{4.98} \end{array}$

3. $\begin{array}{r} 7062\\ \underline{-\ 3948} \end{array}$

4. $\begin{array}{r} \$805.03\\ \underline{-\ 28.65} \end{array}$

5. $\begin{array}{r} 849\\ \underline{\times\ 56} \end{array}$

6. $\begin{array}{r} \$7.06\\ \underline{\times\ 48} \end{array}$

7. $7\overline{)2772}$ $\quad$ **8.** $8\overline{)5735}$ $\quad$ **9.** $9\overline{)5317}$ $\quad$ **10.** $63\overline{)4681}$

11. Write in figures: ninety-six thousand, eighty-nine.

12. Find the average of 63, 72, 45, and 90.

13. If 5 boys share 4 ice-cream bars, what part of a bar will each boy get?

14. N × 36 = 756, so N = __?__.

Help in long division

You cannot do good work in long division unless you can multiply and subtract accurately. Examples like Exs. 1 to 4 below will help you do Exs. 5 to 10 more easily.

Multiply, using folded paper:

	a	*b*	*c*	*d*	*e*
1.	$\begin{array}{r}75\\ \underline{7}\end{array}$	$\begin{array}{r}82\\ \underline{3}\end{array}$	$\begin{array}{r}54\\ \underline{6}\end{array}$	$\begin{array}{r}93\\ \underline{5}\end{array}$	$\begin{array}{r}99\\ \underline{4}\end{array}$
2.	$\begin{array}{r}94\\ \underline{4}\end{array}$	$\begin{array}{r}65\\ \underline{5}\end{array}$	$\begin{array}{r}99\\ \underline{8}\end{array}$	$\begin{array}{r}43\\ \underline{9}\end{array}$	$\begin{array}{r}96\\ \underline{3}\end{array}$

Subtract, using folded paper:

3.	$\begin{array}{r}355\\ \underline{288}\end{array}$	$\begin{array}{r}335\\ \underline{292}\end{array}$	$\begin{array}{r}222\\ \underline{176}\end{array}$	$\begin{array}{r}403\\ \underline{384}\end{array}$	$\begin{array}{r}445\\ \underline{396}\end{array}$
4.	$\begin{array}{r}312\\ \underline{246}\end{array}$	$\begin{array}{r}404\\ \underline{376}\end{array}$	$\begin{array}{r}392\\ \underline{387}\end{array}$	$\begin{array}{r}340\\ \underline{324}\end{array}$	$\begin{array}{r}802\\ \underline{792}\end{array}$

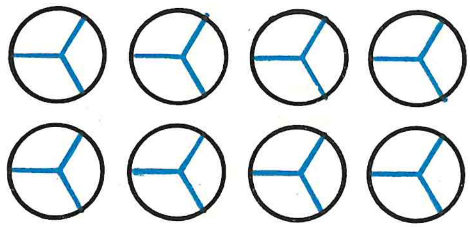
Copy, divide, and check:

5.	$96\overline{)3552}$	$78\overline{)1250}$	$73\overline{)3358}$	$88\overline{)2222}$	$96\overline{)4032}$
6.	$99\overline{)4455}$	$69\overline{)1656}$	$82\overline{)3126}$	$94\overline{)4042}$	$65\overline{)1040}$
7.	$43\overline{)3926}$	$54\overline{)3402}$	$65\overline{)3455}$	$93\overline{)4949}$	$99\overline{)8029}$
8.	$59\overline{)1357}$	$75\overline{)5416}$	$97\overline{)4186}$	$96\overline{)3562}$	$85\overline{)2125}$

9. A city bought 72 slides for its playgrounds and paid $4,680 for them. Can you find the price of each slide?

10. Ann's father usually drives about 35 miles an hour. At that rate, driving 525 miles to Melrose will take _?_ hours.

Thirds



1. Above are 8 equal circles. Each is marked off into thirds.

How many thirds are there in 1 whole circle? in 2 whole circles? in 3 whole circles? in the 8 whole circles?

2. Count the thirds in 4 circles. Does $\frac{12}{3} = 4$?

3. Complete the following statements about the circles:

1 whole = ___?___ thirds
6 thirds = ___?___ wholes
15 thirds = ___?___ wholes
3 wholes = ___?___ thirds
$\frac{1}{3} + \frac{1}{3} + \frac{1}{3} = \frac{?}{3} =$ ___?___
$\frac{2}{3} + \frac{2}{3} = \frac{?}{3} = 1$ whole and $\frac{?}{3}$
$\frac{4}{3} + \frac{2}{3} = \frac{?}{3} =$ ___?___ wholes
$\frac{2}{3} + \frac{2}{3} + \frac{2}{3} = \frac{?}{3} =$ ___?___ wholes

4. Which is larger? Use the circles to prove your answers.

5 or $\frac{16}{3}$	$\frac{11}{3}$ or $3\frac{1}{3}$	$1\frac{1}{3}$ or $\frac{5}{3}$
$\frac{6}{3}$ or 3	$\frac{24}{3}$ or 8	$4\frac{2}{3}$ or $\frac{14}{3}$
$\frac{7}{3}$ or $2\frac{2}{3}$	$\frac{19}{3}$ or $5\frac{4}{3}$	$2\frac{1}{3}$ or $\frac{8}{3}$
4 or $\frac{13}{3}$	$\frac{22}{3}$ or 7	$6\frac{1}{3}$ or $\frac{20}{3}$

5. How many thirds would you need to put together to make 2 wholes? $2\frac{2}{3}$? $4\frac{1}{3}$? 6?

6. $3 - \frac{1}{3} = \frac{?}{3}$ $\quad 5 - 1\frac{1}{3} =$ ___?___
$3 - \frac{2}{3} = \frac{?}{3}$ $\quad 5 - 2\frac{2}{3} =$ ___?___
$6\frac{1}{3} - \frac{2}{3} = \frac{?}{3}$ $\quad 5\frac{2}{3} - 1 = \frac{?}{3}$

7. How many $\frac{1}{3}$'s are there in 2? in 3? in 4?

8. Jane had 7 sticks of peppermint candy. She divided each stick into thirds.

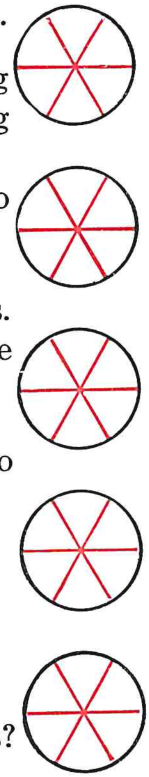
Did she have enough pieces then, so that each of the 20 girls in her class could have one? Did she have a piece for the teacher too?

9. Tom's mother baked 3 cherry pies. Tom and Bill each ate $\frac{1}{3}$ of a pie. How much pie was left then?

10. Harriet wants to mix $\frac{2}{3}$ cup of orange juice, $\frac{2}{3}$ cup of grapefruit juice, and $\frac{2}{3}$ cup of cherry juice. Will a pint bottle be large enough to hold the mixture?

11. Have you ever needed to divide anything into thirds? What was it you needed to divide? Tell the class about it.

Sixths



1. Show how to fold a piece of string into halves; into thirds.

2. Mary said there are two ways to fold a piece of string into *sixths*. In the first way, she started by folding the string into halves. Show what she did next. Does $\frac{1}{3}$ of $\frac{1}{2} = \frac{1}{6}$?

In the second way, Mary started by folding the string into thirds. Show what she did next. Does $\frac{1}{2}$ of $\frac{1}{3} = \frac{1}{6}$?

3. The 5 equal circles at the right are marked off into sixths. How many $\frac{1}{6}$ths are there in 1 whole circle? in 2 whole circles? in all the circles?

4. Tom was counting the sixths. He said, as he pointed to the sixths:

1 sixth	5 sixths
2 sixths	6 sixths, or 1 whole
3 sixths	7 sixths, or 1 whole and one sixth
4 sixths	8 sixths, or 1 whole and 2 sixths

What should he say when he counts 12 sixths? 13 sixths? 19 sixths?

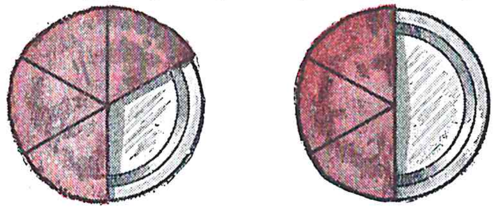
5. Which is larger? Use the circles to prove your answers.

12 sixths or 2	$1\frac{1}{6}$ or $\frac{7}{6}$	$\frac{24}{6}$ or 4	$\frac{8}{6}$ or $1\frac{1}{2}$	$\frac{12}{6}$ or $2\frac{1}{6}$
17 sixths or 3	$2\frac{3}{6}$ or $\frac{15}{6}$	$\frac{27}{6}$ or $4\frac{1}{2}$	$\frac{5}{6}$ or 1	$\frac{18}{6}$ or $2\frac{5}{6}$
25 sixths or 4	$3\frac{1}{6}$ or $\frac{19}{6}$	$\frac{13}{6}$ or $1\frac{7}{6}$	$\frac{9}{6}$ or $1\frac{1}{2}$	$\frac{10}{6}$ or 2

6. Tom said he could see halves, thirds, and sixths in each of the circles. Can you?

7. How many sixths would you give for $\frac{1}{2}$? $\frac{1}{3}$? $\frac{2}{3}$? $1\frac{2}{3}$? $2\frac{1}{2}$? $5\frac{1}{6}$?

8. Jane baked two pies. The picture shows how much pie she has left. Does she have as much as a whole pie left? How can you tell?



Be your own teacher

Good thinkers can do these examples mentally. Can you?

1. What is the sum of $98.50 and $101.15?

2. Is 8 × $3.02 closer to $24.00 or to $24.10?

3. Is $\frac{1}{7}$ of $28.56 closer to $4.00 or to $4.25?

4. In $123.04 the 1 stands for $100. What does the 2 stand for? the 3? the 0? the 4?

5. George gave the storekeeper ten dollars to pay a bill amounting to $3.95. How much change should George receive?

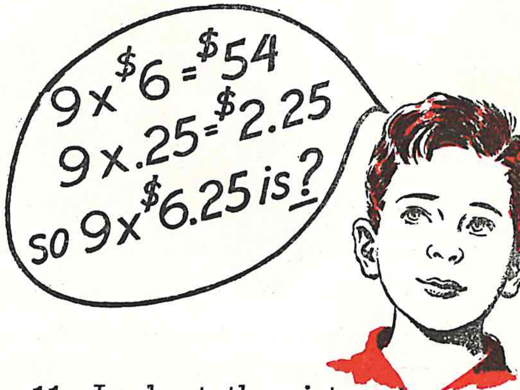
6. What four pieces of paper money and what two coins could you use to pay a bill that amounted to $1111.11?

7. Ann said that $\frac{1}{8}$ of $7198 is very close to $900. How could she tell?

8. How much less than $30 is the cost of 6 pairs of skates at $4.95 a pair?

9. Does 483 ÷ 23 equal "20 some" or "30 some"?

10. Does 1980 ÷ 9 equal about 200 or 2000?



11. Look at the picture to see how Philip finds 9 × $6.25.

Use Philip's method (Ex. 11) to find these products:

12.	9 × $5.25	8 × $3.20
13.	7 × $6.50	8 × $7.20
14.	8 × $25.50	7 × $2.25
15.	6 × $15.20	6 × $9.80
16.	7 × $12.08	8 × $8.12

Subtract each of these numbers from $10.00:

17.	$1.98	$3.95	$4.05
18.	$7.98	$8.15	$9.35

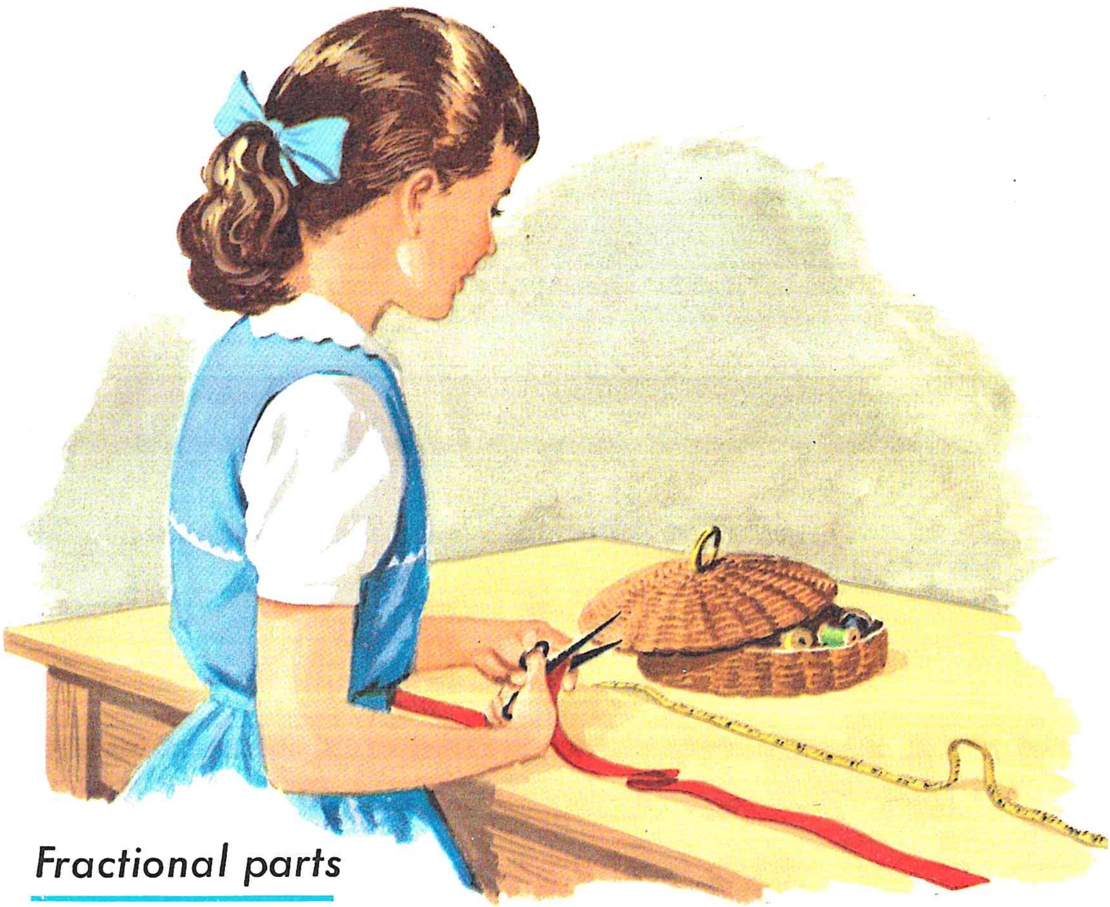
19. How many of each of these could you buy for $10.00?

1-cent stamps	10-cent tops
4-cent erasers	5-cent candy bars
50-cent knives	25-cent notebooks

20. How many $\frac{1}{8}$'s are there in 1 whole? in 2? in 3?

21. If a whole is 8 eighths, then a half is _?_ eighths.

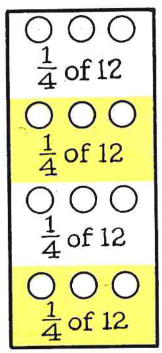
To the Teacher: See Note 2 on page 310.



Fractional parts

Debby wants to measure off $\frac{3}{4}$ yd. of ribbon for a hair bow. Her tape measure is marked off in inches. Do you know how many inches there are in $\frac{3}{4}$ yd.?

Debby thought, "One yard equals 36 inches; $\frac{1}{4}$ yd. equals $\frac{1}{4}$ of 36 inches, or 9 inches; $\frac{3}{4}$ yd. equals 3 times 9 inches, or 27 inches." Was Debby right?



1. At the right are 12 circles divided into 4 equal groups. Each group of circles is $\frac{1}{4}$ of the 12 circles. How many circles are there in $\frac{1}{4}$ of 12 circles? in $\frac{3}{4}$ of 12 circles? in $\frac{2}{4}$ of 12 circles?

2. To find $\frac{3}{4}$ of 16, I think, "$\frac{1}{4}$ of 16 is 4; so $\frac{3}{4}$ of 16 is 3 times 4, or ___?___."

3. To find $\frac{3}{8}$ of 24, I think, "$\frac{1}{8}$ of 24 is ___?___; so $\frac{3}{8}$ of 24 is 3 times 3, or ___?___."

4. $\frac{1}{8}$ of 16 is 2; so $\frac{3}{8}$ of 16 is 3 times 2, or $\underline{\ ?\ }$. $\frac{5}{8}$ of 16 = $\underline{\ ?\ }$.

5. $\frac{1}{8}$ of 40 is 5; so $\frac{7}{8}$ of 40 is 7 times 5, or $\underline{\ ?\ }$. $\frac{3}{8}$ of 40 = $\underline{\ ?\ }$.

6. $\frac{1}{3}$ of 12 is 4; so $\frac{2}{3}$ of 12 is 2 times $\underline{\ ?\ }$, or $\underline{\ ?\ }$. $\frac{3}{4}$ of 12 = $\underline{\ ?\ }$.

7. $\frac{1}{6}$ of 30 is 5; so $\frac{5}{6}$ of 30 is $\underline{\ ?\ }$ times 5, or $\underline{\ ?\ }$. $\frac{3}{6}$ of 30 = $\underline{\ ?\ }$.

8. $\frac{1}{5}$ of 25 is $\underline{\ ?\ }$; so $\frac{4}{5}$ of 25 is $\underline{\ ?\ }$ times $\underline{\ ?\ }$, or $\underline{\ ?\ }$. $\frac{3}{5}$ of 25 = $\underline{\ ?\ }$.

9. $\frac{1}{8}$ of 32 is $\underline{\ ?\ }$. $\frac{3}{8}$ of 32 is $\underline{\ ?\ }$. $\frac{5}{8}$ of 32 is $\underline{\ ?\ }$. $\frac{7}{8}$ of 32 = $\underline{\ ?\ }$.

10. $\frac{1}{6}$ of 48 is $\underline{\ ?\ }$. $\frac{3}{6}$ of 48 is $\underline{\ ?\ }$. $\frac{5}{6}$ of 48 is $\underline{\ ?\ }$. $\frac{4}{6}$ of 48 = $\underline{\ ?\ }$.

11. $\frac{1}{8}$ of 56 is $\underline{\ ?\ }$. $\frac{5}{8}$ of 56 is $\underline{\ ?\ }$. $\frac{7}{8}$ of 56 is $\underline{\ ?\ }$. $\frac{3}{8}$ of 56 = $\underline{\ ?\ }$.

12. $\begin{cases}\frac{1}{3} \text{ of } 24 \text{ is } \underline{\ ?\ }. \\ \frac{2}{3} \text{ of } 24 \text{ is } \underline{\ ?\ }.\end{cases}$ $\begin{cases}\frac{1}{4} \text{ of } 16 \text{ is } \underline{\ ?\ }. \\ \frac{2}{4} \text{ of } 16 \text{ is } \underline{\ ?\ }.\end{cases}$ $\begin{cases}\frac{1}{3} \text{ of } 27 \text{ is } \underline{\ ?\ }. \\ \frac{2}{3} \text{ of } 27 \text{ is } \underline{\ ?\ }.\end{cases}$ $\begin{cases}\frac{1}{4} \text{ of } 36 \text{ is } \underline{\ ?\ }. \\ \frac{3}{4} \text{ of } 36 \text{ is } \underline{\ ?\ }.\end{cases}$

13. $\begin{cases}\frac{1}{5} \text{ of } 20 \text{ is } \underline{\ ?\ }. \\ \frac{2}{5} \text{ of } 20 \text{ is } \underline{\ ?\ }.\end{cases}$ $\begin{cases}\frac{1}{3} \text{ of } 18 \text{ is } \underline{\ ?\ }. \\ \frac{2}{3} \text{ of } 18 \text{ is } \underline{\ ?\ }.\end{cases}$ $\begin{cases}\frac{1}{8} \text{ of } 72 \text{ is } \underline{\ ?\ }. \\ \frac{6}{8} \text{ of } 72 \text{ is } \underline{\ ?\ }.\end{cases}$ $\begin{cases}\frac{1}{5} \text{ of } 40 \text{ is } \underline{\ ?\ }. \\ \frac{4}{5} \text{ of } 40 \text{ is } \underline{\ ?\ }.\end{cases}$

14. $\begin{cases}\frac{1}{8} \text{ of } 16 = \underline{\ ?\ }. \\ \frac{5}{8} \text{ of } 16 = \underline{\ ?\ }.\end{cases}$ $\begin{cases}\frac{1}{4} \text{ of } 32 = \underline{\ ?\ }. \\ \frac{3}{4} \text{ of } 32 = \underline{\ ?\ }.\end{cases}$ $\begin{cases}\frac{1}{5} \text{ of } 35 = \underline{\ ?\ }. \\ \frac{4}{5} \text{ of } 35 = \underline{\ ?\ }.\end{cases}$ $\begin{cases}\frac{1}{6} \text{ of } 30 = \underline{\ ?\ }. \\ \frac{5}{6} \text{ of } 30 = \underline{\ ?\ }.\end{cases}$

Write the answers to these examples:

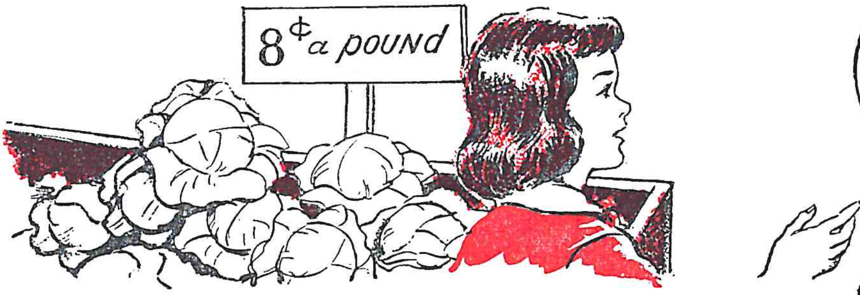
	a	b	c	d	e
15.	$\frac{3}{4}$ of 8	$\frac{3}{8}$ of 40	$\frac{5}{6}$ of 48	$\frac{5}{8}$ of 56	$\frac{2}{6}$ of 30
16.	$\frac{2}{3}$ of 15	$\frac{5}{8}$ of 40	$\frac{3}{4}$ of 28	$\frac{3}{6}$ of 24	$\frac{5}{6}$ of 24
17.	$\frac{2}{5}$ of 15	$\frac{2}{3}$ of 24	$\frac{2}{7}$ of 14	$\frac{2}{3}$ of 36	$\frac{4}{9}$ of 36

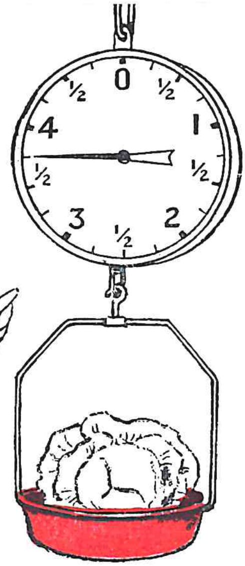
18. Two thirds of a yard of ribbon at 15 cents a yard will cost $\frac{2}{3}$ of 15 cents, or $\underline{\ ?\ }$ cents.

19. Three eighths of a piece of cord that is 24 inches long will be $\frac{3}{8}$ of 24 inches, or $\underline{\ ?\ }$ inches, long.

20. How much should Amy pay for $\frac{3}{4}$ of a pound of cherries that are 24 cents a pound?

21. Sue's fruitcake recipe calls for 6 oz. of candied orange peel. Sue bought $\frac{3}{8}$ lb. of the peel. Did she buy the right amount?





A mixed number times a whole number

Jane is buying a head of cabbage. How much does it weigh?

What will 3 lb. cost? $\frac{1}{4}$ lb.? $\frac{3}{4}$ lb.? Then how much will $3\frac{3}{4}$ lb. cost?

$$\begin{array}{rcr} 3 \times 8¢ & = & 24¢ \\ \frac{3}{4} \times 8¢ & = & \underline{6¢} \\ & & 30¢ \end{array}$$

Find the cost of:

1. $2\frac{1}{2}$ dozen oysters at 40¢ a dozen.
2. A $3\frac{1}{8}$-pound mackerel at 24¢ a pound.
3. A $9\frac{3}{4}$-pound turkey at 60¢ a pound.
4. $2\frac{1}{2}$ dozen oranges at 48¢ a dozen.
5. $2\frac{1}{3}$ dozen rolls at 24¢ a dozen.
6. $1\frac{2}{3}$ yards of lace at 30¢ a yard.
7. $3\frac{1}{4}$ pounds of butter at 80¢ a pound.
8. $2\frac{3}{4}$ pounds of cheese at 36¢ a pound.
9. $5\frac{3}{8}$ yards of sateen at 64¢ a yard.
10. $1\frac{3}{4}$ dozen buns at 28¢ a dozen.

Oral review of measures

If you need help, study the tables on page 309.

1. 1 min. = _?_ sec.	1 yr. = _?_ da.	1 quarter = _?_ nickels
2. 1 day = _?_ hr.	1 yr. = _?_ wk.	1 leap year = _?_ da.
3. 1 wk. = _?_ da.	1 yr. = _?_ mo.	1 quarter = _?_ cents
4. 1 hr. = _?_ min.	1 dime = _?_ cents	1 dollar = _?_ cents

United States money

1. Joe had a dollar bill changed into 5 dimes and ___?___ nickels.

2. Joe has a coin purse with places to hold different coins. It holds 4 quarters, 6 dimes, 4 nickels, and 5 pennies.

When Joe gets it filled, he will have ___?___ dollar and ___?___ cents.

3. Mary has saved 17 nickels. She thought, "I'll have a dollar when I save ___?___ more nickels."

4. Tell the missing numbers in the chart below. Think, "100 pennies are worth as much as ___?___ nickels, or ___?___ dimes, or ___?___ quarters," and so on.

PENNIES	100	?	?	?	?	?
NICKELS	?	10	?	?	?	?
DIMES	?	?	20	?	?	?
QUARTERS	?	?	?	8	?	?
HALF DOLLARS	?	?	?	?	10	?
DOLLARS	?	?	?	?	?	5

5. Can you choose 4 coins to make 86 cents?

Compare the following. In each pair tell which is larger.

6. \$100 or 110¢   25 dimes or \$2   8 quarters or 18 dimes

7. 225¢ or \$2.50 $.37\frac{1}{2}$ or 4 dimes   50 nickels or 24 dimes

8. $12\frac{1}{2}$¢ or $12\frac{1}{4}$¢   2¢ or $\frac{1}{10}$ of a dime   18 dimes or 35 nickels

9. 3 dollars = 2 dollars and ___?___ quarters.

10. 5 dollars = 4 dollars and ___?___ half dollars.

11. Read these amounts of money:

\$.90	\$9.09	\$900.90	\$9090.09	\$9909.90
\$1,000,000	\$100,000	\$5,000,000	\$3,000,000	\$2,100,000

Making change

Dave sometimes works in his father's flower shop. When he gives a customer change from a 1-dollar bill after a 60-cent purchase, this is what he does:

First he says, "Sixty."

Then, handing the customer a nickel, he says, "Sixty-five"; handing him a dime, he says, "Seventy-five"; and handing him a quarter, he says, "One dollar."

The **a** *columns show the customers' bills. The* **b** *columns show the money handed Dave. What change did Dave give the customers and what did he say as he handed it to them?*

	a	b		a	b		a	b		a	b
1.	3¢	5¢	**8.**	37¢	50¢	**15.**	49¢	$1.00	**22.**	$4.67	$5.00
2.	7¢	10¢	**9.**	52¢	60¢	**16.**	34¢	$1.00	**23.**	$2.07	$5.00
3.	12¢	25¢	**10.**	87¢	$1.00	**17.**	27¢	$1.00	**24.**	$1.98	$5.00
4.	14¢	25¢	**11.**	76¢	$1.00	**18.**	18¢	$1.00	**25.**	$1.76	$5.00
5.	16¢	25¢	**12.**	73¢	$1.00	**19.**	$.73	$2.00	**26.**	$8.87	$10.00
6.	21¢	25¢	**13.**	65¢	$1.00	**20.**	$.89	$2.00	**27.**	$4.23	$10.00
7.	21¢	50¢	**14.**	53¢	$1.00	**21.**	$.65	$2.00	**28.**	$1.94	$10.00

29. A lady bought a pot of African violets and a half-dozen chrysanthemums. (See chart below.)

How much change did she get from a 5-dollar bill?

30. A man bought 4 flowerpots at 5¢ each, and a pot of marigolds.

How much change did he get from $10?

31. How much did Dave charge for one and one-half dozen large red roses?

32. When Dave finished work on Saturday, he had to fill in the numbers in the last two columns of the chart below.

Find these numbers. Then find the total of the last column.

PLANTS	NO. RECEIVED	NO. LEFT	PRICE	NO. SOLD	AMT.
African Violets	10 pots	6 pots	95¢ a pot	4	$3.80
Marigolds	15 pots	4 pots	40¢ a pot	?	?
Asters	10 pots	2 pots	95¢ a pot	?	?
Chrysanthemums	15 doz.	4 doz.	$3.00 a doz.	?	?
Zinnias	16 pots	3 pots	60¢ a pot	?	?
Bittersweet	25 bunches	8 bunches	50¢ a bunch	?	?
Bayberry	18 bunches	5 bunches	65¢ a bunch	?	?
Gladioli	20 doz.	9 doz.	$1.50 a doz.	?	?
Roses	100	20	15¢ each	?	?

United States money

Here are the names of some kinds of paper money used in the United States:

\$ 1 bill	\$ 1,000 bill
\$ 10 bill	\$ 10,000 bill
\$100 bill	\$100,000 bill

1. How many \$10 bills would you give for a \$100 bill? How many \$100 bills for a \$1,000 bill?

Which of the above bills, and how many of each, would you give to make up these amounts?
(Use as few bills as possible.)

	a	*b*
2.	\$ 4,680	\$ 176,208
	\$62,483	\$1,000,000
3.	\$ 5,074	\$ 407,574
	\$70,362	\$1,200,000

Write in numbers with the dollar sign and cents point:

4. One hundred dollars and thirty-one cents

5. Six hundred dollars and fifty cents

6. Nine dollars and ninety-nine cents

7. Eighty-seven and one-half cents

Remember: When you add columns of money, you place the dollar sign before only the first addend and before the sum.

$$\begin{array}{r} \$428.32 \\ 36.18 \\ 500.00 \\ \hline \$964.50 \end{array}$$

Place all the cents point in a straight column.

Write in columns, add, and check:

8. \$1000 + \$280.75 + \$50.60

9. \$.49 + \$.75 + \$.08 + \$.63

10. 65¢ + 39¢ + 72¢ + 5¢

11. \$304.72 + \$756.35 + \$480.40

12. \$25 + \$9.46 + \$.57 + \$2

13. \$753.62 + \$19.34 + \$76

14. \$473 + \$289.75 + \$16.38

15. \$18.95 + \$7.32 + \$263.45

16. Ann has a United States Savings Bond worth \$18.75, and also \$9.75 in Savings Stamps.

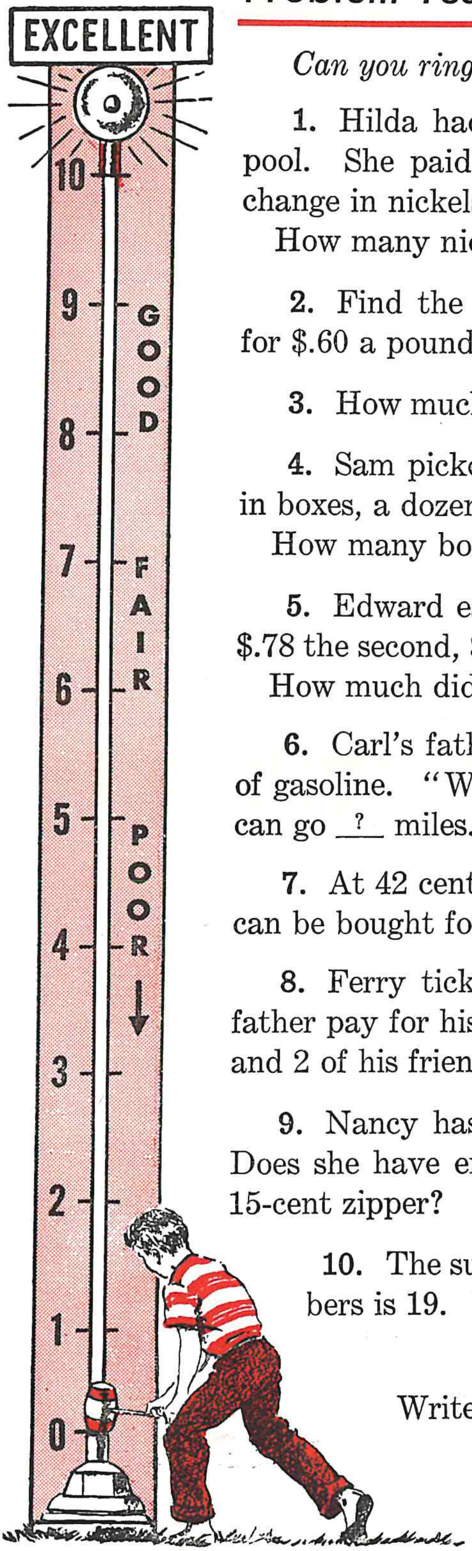
How much has she saved in stamps and bonds all together?

17. George bought a suit for \$23.75, shoes for \$5.25, and a cap for \$1.75.

He estimated that the cost of all was \$24 + \$5 + \$2.

Was his estimate too high, or too low?

Problem Test 2



Can you ring the bell in problem solving?

1. Hilda had a half dollar to spend at the swimming pool. She paid 15 cents for her ticket and received her change in nickels.
How many nickels did Hilda get?

2. Find the cost of $2\frac{3}{4}$ lb. of chopped steak that sells for $.60 a pound.

3. How much will eight 25-cent Savings Stamps cost?

4. Sam picked 144 tomatoes. He wants to pack them in boxes, a dozen tomatoes to a box.
How many boxes will Sam need?

5. Edward earned $1.48 the first Saturday in October, $.78 the second, $.96 the third, and $1.25 the last Saturday.
How much did he earn in all?

6. Carl's father says he can drive 15 miles on 1 gallon of gasoline. "With 5 gallons in the tank," says Carl, "we can go _?_ miles."

7. At 42 cents a pound, how many pounds of date bars can be bought for 90 cents?

8. Ferry tickets cost 16 cents. How much will Bill's father pay for his own ticket and 3 half-fare tickets for Bill and 2 of his friends?

9. Nancy has $2.25 to spend for material for a dress. Does she have enough to buy 3 yd. of 79-cent silk and a 15-cent zipper?

10. The sum of two numbers is 56. One of the numbers is 19. What is the other number?

Write your score on your Problem Test Record.

Self-Help Test 1

If you make mistakes in a Self-Help Test, the number at the right of an example tells you on what page you can find help. Where can you find help for Ex. 1 of this test?

1. The number 12,046,214 is read: ? million, ? thousand, ?. **(6)**

2. Copy these numbers and place the commas correctly:

605950	2045680
214356	42385620
15340415	35080099 **(7)**

3. Write in Arabic numerals:

XXI	XLIV	LXIX	XVI
XIX	XXIX	LV	**(27–28)**

4. Draw 3 circles. Divide each circle into eighths. Shade $\frac{1}{4}$ of one circle; $\frac{3}{4}$ of one; $\frac{5}{8}$ of one. **(41)**

5. Draw 4 squares. Divide each square into halves and then into sixths. Shade $\frac{1}{6}$ of one square; $\frac{1}{3}$ of one; $\frac{1}{2}$ of one; $\frac{5}{6}$ of one. **(106)**

6. What is $\frac{1}{8}$ of these numbers?

24 16 40 56 **(53)**

7. 48 inches of tape can be cut into ? 6-inch pieces. **(52)**

Self-Help Test 2

1. $\frac{1}{3}$ of 2 = ? **(48)**

2. $2 \div 3$ = ? **(48)**

3. $\frac{1}{4}$ of 3 = ? **(48)**

4. $3 \div 4$ = ? **(48)**

5. If you divide 2 bricks of ice cream equally among 5 boys, what part of a brick will each boy receive? **(49)**

6. What is the remainder when you divide 25 cents equally among 4 boys? Can you divide the remainder? **(56–58)**

7. (*a*) $\frac{1}{3}$ of 7 in. = ? in.

(*b*) $\frac{1}{3}$ of 13 in. = ? in.

(*c*) $\frac{1}{4}$ of 5 ft. = ? ft.

(*d*) $\frac{1}{4}$ of 9 yd. = ? yd.

(*e*) $\frac{1}{2}$ of 5 qt. = ? qt. **(58)**

8. Divide 67 by 32; 93 by 40; 87 by 21. **(78–81)**

9. Which of the following is larger than 1? equal to 1? smaller than 1?

$7 \div 8$ $8 \div 7$ $\frac{1}{8}$ of 8 **(57)**

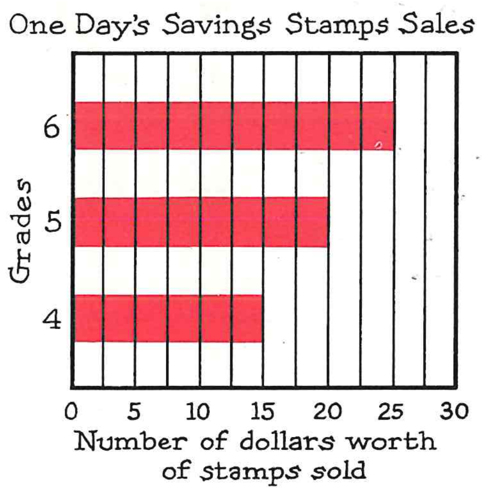
10. $9\overline{)2097}$ $6\overline{)\$20.58}$ **(62–63)**

Self-Help Test 3

1. Doris is making 8 curtains for her bedroom windows. She needs 54 in. of material for each curtain, or _?_ yds. in all. **(88–92)**

2. Look at the graph below. How many dollars worth of Savings Stamps were bought in one day by sixth-grade pupils? by fifth-grade pupils? by fourth-grade pupils?

Which grade bought the most Savings Stamps that day? **(86)**



3. There are 256 children in the glee clubs of Harrison School. How many buses will be needed to carry them to the high school for a concert, if each bus holds 32 children? **(80–81)**

4. Find $\frac{3}{8}$ of 32; of 48; of 24; of 40. **(108–109)**

5. How many whole circles can you make by fitting together 8 half circles? **(42)**

6. Find the cost of $3\frac{3}{4}$ yards of muslin at 24 cents a yard. **(110)**

7. Write in figures, using dollar sign and cents point:

- nine hundred sixty-four dollars and fifty cents
- five hundred dollars and five cents
- four hundred three dollars and seventy cents **(112)**

8. 175 ÷ 34 = _?_ **(80–81)**

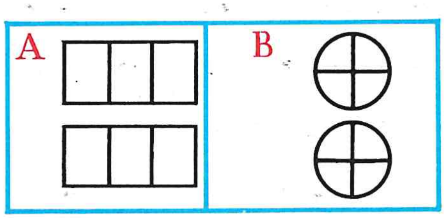
9. 749 ÷ 33 = _?_ **(88–92)**

10. 1909 ÷ 56 = _?_ **(96–97)**

11. Write either *Yes* or *No* for each answer.

- Is 325 cents equal to \$3.25?
- Does \$1 less \$.49 equal \$.51?
- Is \$3 more than 10 dimes?
- Is $37\frac{1}{2}$¢ equal to $\$.37\frac{1}{2}$? **(111)**

12. How many $\frac{1}{3}$'s are there in 2? Which picture below shows you the answer? **(105)**



Measuring your growth in arithmetic

Work carefully. Check your answers. Be sure your answers are sensible.

1. Divide and check: $42\overline{)96}$

2. Divide 768 by 36. Check.

3. Jean needs $2\frac{3}{8}$ yd. of sateen for a street carnival costume. At 40 cents a yard, how much will the sateen cost?

4. The 12 boys in a stamp club want to share equally 288 stamps. How many will each receive?

5. How long will it take a train traveling at an average speed of 45 mi. an hour to go 225 mi.?

6. Peter read about a transport plane that travels 180 mi. an hour. At that rate, how far would it travel in 4 hr.?

7. Write each of the following amounts with a dollar sign and a cents point:

$87\frac{1}{2}$ cents	175 cents
nineteen dollars	7 cents

8. How much will Mary have to pay for $\frac{5}{8}$ lb. of candy at 40 cents a pound?

9. How many 52's are there in 3,952? Check your answer.

10. John found the story of the flight of the *Winnie Mae* in Volume XIX of the school's encyclopedia and in Chapter XXIV of *Famous Flights.*

Write the two numbers with Arabic numerals.

Just for fun

1. Using 4 twos, write a number equal to 23.

2. Using 4 twos, write a number equal to 1.

3. Using 4 fours, write a number equal to 45.

4. Using 4 nines, write a number equal to 100.

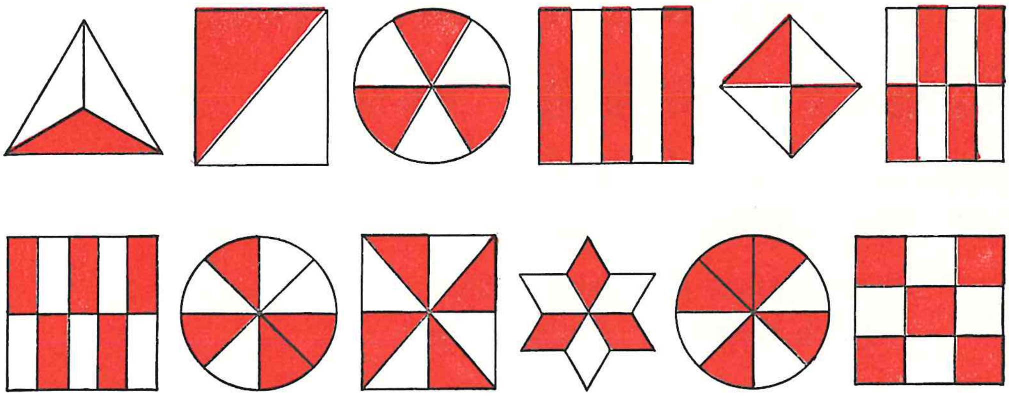
5. Using 3 fives, write a number equal to 6.

6. Using 3 fives, write a number equal to 11.

UNIT 15

Terms of a fraction. Comparing fractions. Kinds of fractions. Changing improper fractions to mixed numbers

What you know about fractions



1. Into how many equal parts is each design above divided?

2. What part of each design is colored? What part is not colored? Write your answers as fractions.

3. In group (*d*) at the right, 3 out of 5 balls, or $\frac{3}{5}$ of the balls, are colored.

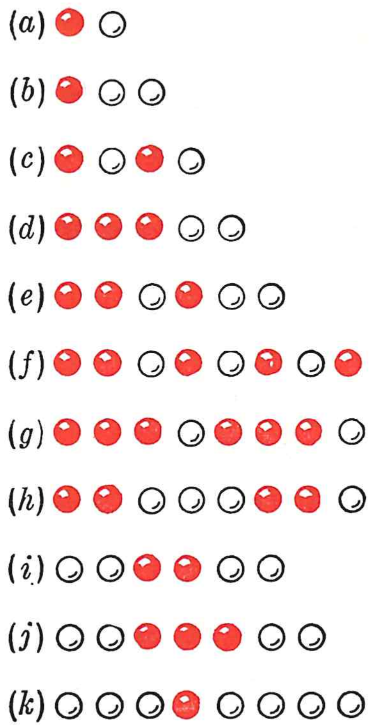
Tell what part of the balls in each of the other groups are colored.

Tell what part are not colored.

4. In group (*a*), what part of the balls are colored? Can you find any other groups in which one half of the balls are colored? Does $\frac{2}{4} = \frac{1}{2}$? Does $\frac{3}{6} = \frac{1}{2}$? Does $\frac{4}{8} = \frac{1}{2}$?

5. How many white balls would you have to add to group (*c*) so that one third of the balls would be colored? What could you take away from group (*c*) to have one third of the balls colored?

6. How many white balls would you have to add to group (*d*) so that half the balls would be white?



What you know about fractions

1. Larry arranged 12 marbles like this to find $\frac{1}{4}$ of 12:

$\frac{1}{4}$ of 12 marbles is _?_ marbles.

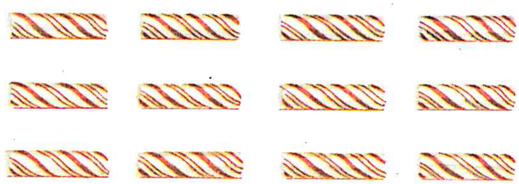
2. How would he arrange the marbles to show $\frac{1}{3}$ of 12?

3. By what would you divide to find:
   $\frac{1}{4}$ of a number? $\frac{1}{5}$ of a number? $\frac{1}{8}$? $\frac{1}{6}$? $\frac{1}{10}$?

Tell the answers to the following.

	a	*b*	*c*	*d*
4.	$\frac{1}{3}$ of 12	$\frac{1}{4}$ of 20	$\frac{1}{5}$ of 30	$\frac{1}{6}$ of 42
5.	$\frac{1}{7}$ of 91	$\frac{1}{8}$ of 96	$\frac{1}{9}$ of 108	$\frac{1}{7}$ of 210
6.	$\frac{1}{8}$ of 416	$\frac{1}{7}$ of 497	$\frac{1}{9}$ of 810	$\frac{1}{8}$ of 6400

7. This drawing shows how 4 girls shared 3 candy sticks. What part of the first stick did each get? What part of the second? the third? Each got _?_ fourths of a stick.
   $3 \div 4 =$ _?_ $\frac{1}{4}$ of $3 =$ _?_



Make up a problem in which you would need to use each of the following:

8.	$\frac{1}{3}$ of 2	$\frac{1}{2}$ of 5	$\frac{1}{4}$ of 5	$\frac{1}{5}$ of 3	$\frac{1}{3}$ of 4
9.	$2 \div 5$	$2 \div 3$	$5 \div 3$	$3 \div 6$	$4 \div 5$

10. At 84¢ a pound, find the cost of $\frac{1}{4}$ lb. of ham; $\frac{3}{4}$ lb.

11. Do $2 \div 3$ and $\frac{1}{3}$ of 2 have the same answer?

12. Is 9 ounces more or less than $\frac{1}{2}$ pound?

Numerator and denominator

Joan baked this blueberry pie. She cut it into 5 equal parts. She took a piece herself and treated 2 of her friends. The girls ate $\frac{3}{5}$ of the pie.

1. In the fraction $\frac{3}{5}$, which number tells you how many parts were eaten? Which number tells into how many equal parts Joan cut the pie?

When a pie is divided into 5 equal pieces, each piece is a __?__ of the pie.

3 ←The number above the line in a fraction is the ***numerator***. This numerator tells you that 3 equal parts of the pie were eaten.

5 ←The number below the line in a fraction is the ***denominator***. This denominator tells that the whole pie was divided into 5 equal parts. When a whole is divided into 5 equal parts, the name and size of each part is a fifth.

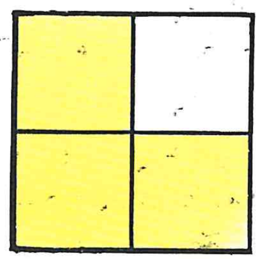
2. Name the numerator and the denominator in each fraction:

$\frac{1}{2}$ $\frac{3}{4}$ $\frac{1}{6}$ $\frac{4}{5}$ $\frac{1}{3}$ $\frac{4}{8}$ $\frac{3}{3}$ $\frac{5}{4}$ $\frac{9}{2}$

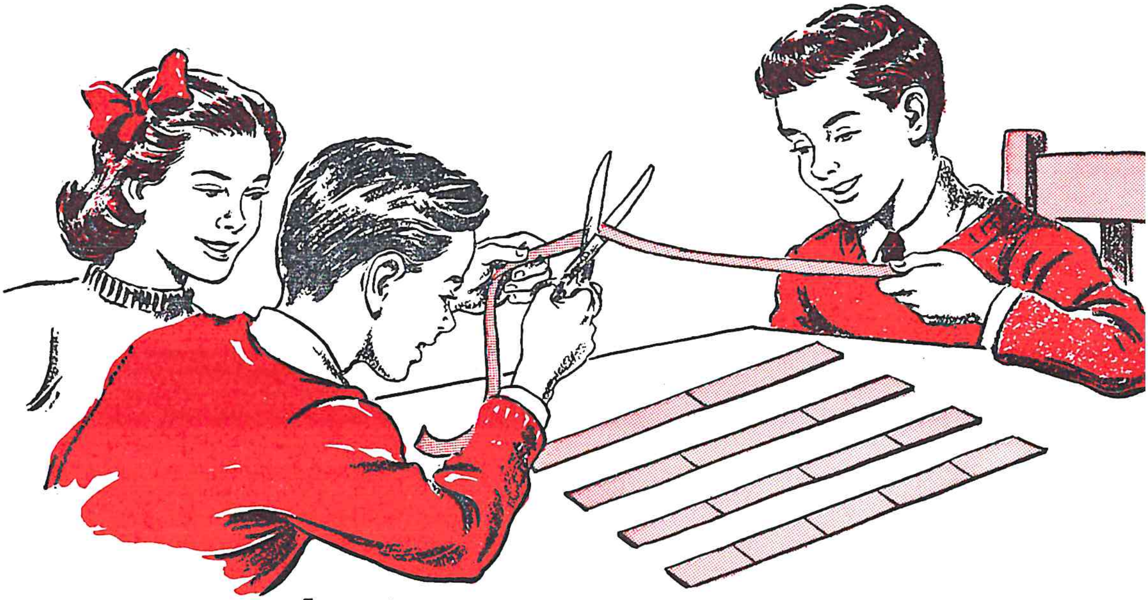
3. Answer these questions about each fraction in **Ex.** 2:

- Into how many equal parts is the whole divided?
- What is the name and size of each of the equal parts?
- How many of the equal parts are talked about in the fraction?

4. Answer these questions about the square:



- Into how many equal parts is it divided?
- How many parts are colored?
- What fractional part of the square is colored?
- In the fraction $\frac{3}{4}$, what is the numerator and what is the denominator?



Comparing fractions

1. Miss Green's pupils are cutting up long strips of leather to make bookmarks.

Which is longer: $\frac{1}{2}$ of a leather strip or $\frac{1}{3}$ of the strip? Why? Does the picture help you decide?

2. Which is longer: $\frac{1}{3}$ of a leather strip or $\frac{1}{4}$ of the strip? Why?

3. Which is longer: $\frac{1}{2}$ of a leather strip or $\frac{1}{4}$ of the strip? $\frac{1}{3}$ or $\frac{1}{5}$? $\frac{1}{4}$ or $\frac{1}{6}$? $\frac{1}{2}$ or $\frac{1}{8}$? $\frac{1}{3}$ or $\frac{1}{10}$? $\frac{1}{4}$ or $\frac{1}{8}$?

4. Can you make up a rule that will help you tell which of these fractions is largest?

$\frac{1}{4}$ $\frac{1}{3}$ $\frac{1}{8}$ $\frac{1}{10}$ $\frac{1}{5}$ $\frac{1}{2}$ $\frac{1}{6}$

5. Which of the fractions in Ex. 4 is smallest? How do you know?

6. Find $\frac{1}{2}$ of 24; $\frac{1}{3}$ of 24. Which is larger? Does this show that $\frac{1}{2}$ is larger than $\frac{1}{3}$?

7. Find $\frac{1}{3}$ of 36; $\frac{1}{4}$ of 36. Is $\frac{1}{3}$ larger than $\frac{1}{4}$?

8. Find $\frac{1}{5}$ of 40; $\frac{1}{4}$ of 40. Is $\frac{1}{5}$ larger than $\frac{1}{4}$?

9. Are these statements true?

- The more equal pieces you cut something into, the smaller each piece will be.
- In Ex. 4 the denominators tell the size of the parts.

10. Which would you rather have:

$\frac{1}{2}$ dozen candy canes or $\frac{1}{3}$ dozen?
$\frac{1}{4}$ dozen canes or $\frac{1}{3}$ dozen?
$\frac{1}{6}$ dozen or $\frac{1}{2}$ dozen?
$\frac{1}{2}$ dozen or $\frac{1}{4}$ dozen?

Kinds of fractions

1. Mary helped her mother get the oranges ready for breakfast.

Each of the 6 persons in the family was to have $\frac{1}{2}$ of an orange. The 6 persons would get 6 halves, or $\frac{6}{2}$ oranges.

Mary wondered how many whole oranges she needed. Do you know?

2. Mary made this drawing to help her. It shows that she needed __?__ whole oranges. Does $\frac{6}{2} = 3$?

3. Count the halves of oranges this way: $\frac{1}{2}$, $\frac{2}{2}$, $\frac{3}{2}$, and so on.

4. Now count the oranges by halves this way: $\frac{1}{2}$, 1, $1\frac{1}{2}$, and so on.

5. Are these statements true?

$\frac{3}{2} = 1\frac{1}{2}$ $\qquad$ $\frac{5}{2} = 2\frac{1}{2}$

$\frac{4}{2} = 2$ $\qquad$ $\frac{6}{2} = 3$

Fractions like $\frac{3}{2}$, $\frac{9}{4}$, $\frac{7}{6}$, $\frac{5}{3}$, and $\frac{4}{4}$ are ***improper fractions.***

In an improper fraction, the numerator is as large as the denominator, or larger. It shows that we are talking about a whole or more than a whole.

Fractions like $\frac{1}{2}$, $\frac{1}{4}$, $\frac{5}{6}$, $\frac{2}{5}$, and $\frac{3}{8}$ are ***proper fractions.***

In a proper fraction, the numerator is smaller than the denominator. It shows that we are talking about less than a whole.

Numbers like 1, 3, 6, 8, and 12 are ***whole numbers.***

Numbers like $1\frac{2}{3}$, $2\frac{1}{4}$, $4\frac{1}{6}$, and $5\frac{3}{8}$ are ***mixed numbers.*** Can you think why we call them that?

6. Name some proper fractions, improper fractions, and mixed numbers.

Tell whether the following are proper fractions, improper fractions, or mixed numbers:

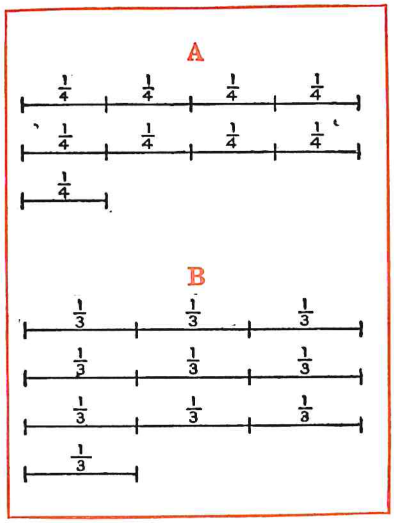
	a	b	c	d	e	f	g
7.	$2\frac{1}{3}$	$\frac{7}{8}$	$4\frac{3}{4}$	$\frac{12}{5}$	$\frac{3}{5}$	$\frac{24}{8}$	$\frac{4}{4}$
8.	$\frac{9}{10}$	$\frac{5}{6}$	$\frac{18}{5}$	$\frac{15}{7}$	$\frac{12}{6}$	$4\frac{1}{4}$	$2\frac{1}{2}$
9.	$1\frac{7}{8}$	$\frac{5}{5}$	$\frac{21}{4}$	$\frac{7}{9}$	$\frac{11}{2}$	$\frac{17}{4}$	$\frac{11}{12}$

Changing improper fractions to mixed numbers

Ann's mother is making her a new dress. The yoke is to be made of 9 pieces of ribbon each $\frac{1}{4}$ yard long.

Ann said, "I'll go to the store and buy the ribbon. I need 9 quarter-yards."

Her mother said, "Well, don't ask the clerk for 9 quarter-yards. Ask for $2\frac{1}{4}$ yards."



1. How does Diagram A at the right show that $\frac{9}{4}$ yd. $= 2\frac{1}{4}$ yd.?

2. Use Diagram A to show that:

$\frac{5}{4} = 1\frac{1}{4}$ $\quad$ $\frac{8}{4} = 2$

$\frac{7}{4} = 1\frac{3}{4}$ $\quad$ $\frac{6}{4} = 1\frac{2}{4} = 1\frac{1}{2}$

3. Use Diagram B to show that:

$\frac{4}{3} = 1\frac{1}{3}$ $\quad$ $\frac{6}{3} = 2$ $\quad$ $\frac{9}{3} = 3$

$\frac{5}{3} = 1\frac{2}{3}$ $\quad$ $\frac{8}{3} = 2\frac{2}{3}$ $\quad$ $\frac{10}{3} = 3\frac{1}{3}$

4. Copy the table below. Use Diagram B to help you fill in the missing numbers.

Count the thirds this way: ⟶	$\frac{1}{3}$	$\frac{2}{3}$	$\frac{3}{3}$	$\frac{4}{3}$	?	$\frac{6}{3}$	$\frac{7}{3}$	?	?	$\frac{10}{3}$
Count by thirds this way: ⟶	$\frac{1}{3}$	$\frac{2}{3}$	1	$1\frac{1}{3}$	?	2	$2\frac{1}{3}$	?	?	$3\frac{1}{3}$

When you change $\frac{7}{3}$ to a mixed number, think this way:

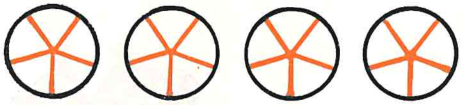
"In one whole there are *3* thirds. To find how many wholes there are in *7* thirds, I must find how many *3's* there are in *7.*"

$\boxed{7 \div 3 = 2\frac{1}{3}}$ $\quad$ $\boxed{\frac{7}{3} = 2\frac{1}{3}}$

5. Which one of these does not mean the same as the others?

$\frac{10}{3}$ $\quad$ $10 \div 3$ $\quad$ $3\overline{)10}$ $\quad$ $3 \div 10$

6. Which is larger, $\frac{8}{3}$ or 3? 2 or $\frac{7}{3}$? 1 or $\frac{4}{3}$? $\frac{5}{3}$ or 2?



7. Each of the above circles is divided into five equal parts.

Count the fifths of the circles, saying $\frac{1}{5}$, $\frac{2}{5}$, $\frac{3}{5}$, $\frac{4}{5}$, $\frac{5}{5}$, $\frac{6}{5}$, and so on.

8. Now count the circles by fifths, saying $\frac{1}{5}$, $\frac{2}{5}$, $\frac{3}{5}$, $\frac{4}{5}$, 1, $1\frac{1}{5}$, $1\frac{2}{5}$, and so on.

9. Use the circles to show that:

$\frac{7}{5} = 1\frac{2}{5}$ $\qquad$ $\frac{9}{5} = 1\frac{4}{5}$

$\frac{10}{5} = 2$ $\qquad$ $\frac{17}{5} = 3\frac{2}{5}$

When you change $\frac{17}{5}$ to a mixed number, think, "In one whole there are *5* fifths. To find how many wholes there are in $\frac{17}{5}$, I must find how many *5*'s there are in *17*."

$\boxed{17 \div 5 = 3\frac{2}{5}}$ $\qquad$ $\boxed{\frac{17}{5} = 3\frac{2}{5}}$

10. Are these statements true?

$7 \div 4 = 1\frac{3}{4}$ and $\frac{7}{4} = 1\frac{3}{4}$

$10 \div 3 = 3\frac{1}{3}$ and $\frac{10}{3} = 3\frac{1}{3}$

$12 \div 5 = 2\frac{2}{5}$ and $\frac{12}{5} = 2\frac{2}{5}$

$8 \div 2 = 4$ and $\frac{8}{2} = 4$

11. Use Ex. 10 to help you make a rule for changing an improper fraction to a whole or a mixed number.

12. Draw 3 pies. Divide each into fifths. Use (1) your picture of pies and (2) the rule you made in Ex. 11 to prove that $\frac{13}{5} = 2\frac{3}{5}$.

13. Use the rule you made in Ex. 11 to change these improper fractions to whole or mixed numbers:

$\frac{9}{4}$	$\frac{13}{5}$	$\frac{17}{3}$	$\frac{10}{5}$	$\frac{16}{3}$
$\frac{25}{3}$	$\frac{12}{5}$	$\frac{13}{2}$	$\frac{17}{2}$	$\frac{12}{2}$
$\frac{25}{5}$	$\frac{9}{2}$	$\frac{11}{3}$	$\frac{14}{4}$	$\frac{13}{6}$

14. How do you find the answer to each of these?

$\frac{1}{6}$ of $24 = \underline{\ ?\ }$ $\qquad$ $6\overline{)24}$ $\qquad$ $6 \times N = 24$

$24 \div 6 = \underline{\ ?\ }$ $\qquad$ $\frac{24}{6} = \underline{\ ?\ }$ $\qquad$ $N \times 6 = 24$

15. Here are some pupils' answers to the question, "What does $3 \div 4$ mean to you?" Is each answer correct?

- $3 \div 4$ means $\frac{1}{4}$ of 3
- $3 \div 4$ means $4\overline{)3}$
- $3 \div 4$ means $\frac{3}{4}$
- $3 \div 4$ means that 3 is being divided into 4 equal parts.

16. What would you say that $4 \div 3$ means?

17. Write each of these as many ways as you can:

54 divided by 9	48 divided by 6
72 divided by 8	49 divided by 7
24 divided by 6	56 divided by 8
28 divided by 7	42 divided by 7
63 divided by 9	27 divided by 3

18. Make up a problem using the fact $54 \div 6 = 9$.

Arithmetic roundup

Oral review

1. If you change the 6 to zero in 860,000, the number becomes ___?___ smaller.

2. Is $5072 \div 52$ about 70, or 80, or 90?

3. Is 6×29 about 120, or 180, or 110?

4. Read these numbers:

5,505 1,100,100 110,010

5. If a 5-lb. bag of nuts costs \$1.75, to find the cost of 1 pound you should ___?___ \$1.75 by ___?___.
One pound costs ___?___¢.

6. To find the difference between \$1.25 and \$.75, you should ___?___.
The difference is ___?___.

7. Which is larger, $\frac{1}{3}$ or $\frac{1}{2}$?

8. Change to mixed numbers:

$\frac{19}{4}$ $\frac{21}{5}$ $\frac{33}{8}$ $\frac{42}{5}$ $\frac{31}{7}$

9. $24 \times 33 = 792$; so $792 \div 24$ = ___?___. Then does $792 \div 25$ equal more than or less than 33?
How do you know?

10. Take the tests on pages 305, 306, 307, and 308.

Written review

1. Add: $275 + 42 + 459 + 75 + 148$

2. Find the sum of \$1.62, \$3.09, \$.75, \$.28, and \$6.95

3. Subtract 3705 from 7604.

4. What is the difference between \$41.50 and \$17.69?

5. What is the product of 985 and 680?

6. Does $\frac{2}{3}$ of 36 equal $\frac{3}{4}$ of 32?

	a	*b*	*c*	*d*	*e*
7.	$8\overline{)5070}$	$7\overline{)4767}$	$33\overline{)429}$	$21\overline{)150}$	$42\overline{)1388}$
8.	$9\overline{)4063}$	$6\overline{)5592}$	$42\overline{)183}$	$32\overline{)1765}$	$61\overline{)2775}$

Finding non-apparent quotient figures
Shortening the division form

UNIT 16

Finding the right quotient figure

Miss Long's class can make 24 puppet show tickets from 1 sheet of cardboard. How many sheets of cardboard should the class buy to make 85 tickets?

"I know we must divide 85 by 24," said Jack.

▶ Jack wrote the example like this: ⟶

$$\begin{array}{r} \surd \\ 24\overline{)85} \end{array}$$

Why did he put one check in the quotient?

How could he tell there would be a one-figure quotient?

▶ Jack thought, "I'll find the number of 2's in 8 to give me a hint of the number of 24's in 85."

▶ He wrote 4 in the quotient; then he multiplied 4 × 24 and wrote 96 under the dividend.

Wrong

$$\begin{array}{r} 4 \\ 24\overline{)85} \\ \underline{96} \end{array}$$

▶ "Something's wrong," said Jack. "I can't subtract to find the remainder."

Miss Long said, "Your quotient figure is too large. Sometimes the hint doesn't give the correct quotient figure.

"Whenever the number to be subtracted is larger than the dividend, you must erase your quotient figure and try the next smaller quotient figure."

▶ Jack started again, trying 3 for his quotient figure. Was the 3 correct?

$$\begin{array}{r} 3 \\ 24\overline{)85} \\ \underline{72} \\ 13 \end{array}$$

From 3 sheets the pupils could make ___?___ tickets. The remainder 13 shows they would still need ___?___ more tickets.

Jack says they need 4 sheets of cardboard. Do you agree?

1. In the divisions below, two different quotient figures have been used for the same example. Which quotient figure is wrong? How can you tell?

Which one is wrong?	
$\begin{array}{r} 6 \\ 27\overline{)139} \\ \underline{162} \end{array}$	$\begin{array}{r} 5 \\ 27\overline{)139} \\ \underline{135} \end{array}$

2. There is one incorrect quotient figure in the divisions below. Find it, and then do the division correctly.

Which one is wrong?		
$\begin{array}{r} 5 \\ 25\overline{)130} \\ \underline{125} \\ 5 \end{array}$	$\begin{array}{r} 9 \\ 46\overline{)414} \\ \underline{414} \end{array}$	$\begin{array}{r} 6 \\ 38\overline{)200} \\ \underline{228} \end{array}$

Finding the right quotient figure

1. In one division at the right, the Hint System works. In the other it doesn't. Which quotient figure needs to be changed? How can you tell?

Which one is wrong?	
$\begin{array}{r} 4 \\ 23\overline{)95} \end{array}$	$\begin{array}{r} 4 \\ 29\overline{)89} \end{array}$

Divide and check:

	a	*b*	*c*	*d*	*e*
2.	$36\overline{)180}$	$39\overline{)234}$	$41\overline{)211}$	$49\overline{)276}$	$45\overline{)280}$
3.	$58\overline{)185}$	$33\overline{)82}$	$66\overline{)558}$	$47\overline{)390}$	$82\overline{)333}$
4.	$75\overline{)369}$	$55\overline{)445}$	$14\overline{)39}$	$51\overline{)426}$	$43\overline{)81}$

5. Just for fun, Bob wanted to see how many times the Hint System did not give the true quotient figure in the divisions at the right.

Each time he had to change a quotient figure he drew a line through the incorrect figure and wrote the true quotient figure above it.

Can you explain all the changes he made in the four divisions?

- How many times did the Hint System fail to give the true quotient figure in tens place? in ones place?
- How many times did Bob get the true quotient figure the first time in both tens and ones places?

$$\begin{array}{r} 3 \\ \cancel{4}6 \\ 46\overline{)1659} \\ \underline{1380} \\ 279 \\ \underline{276} \\ 3 \end{array} \qquad \begin{array}{r} 5 \\ 3\cancel{6} \\ 55\overline{)1955} \\ \underline{1650} \\ 305 \\ \underline{275} \\ 30 \end{array}$$

$$\begin{array}{r} 62 \\ \cancel{7}\cancel{3} \\ 35\overline{)2195} \\ \underline{2100} \\ 95 \\ \underline{70} \\ 25 \end{array} \qquad \begin{array}{r} 23 \\ 24\overline{)555} \\ \underline{480} \\ 75 \\ \underline{72} \\ 3 \end{array}$$

Divide and check. Use Bob's system to show the number of changes you need to make in the quotient figures.

6.	$32\overline{)1730}$	$47\overline{)800}$	$65\overline{)455}$	$26\overline{)1352}$	$68\overline{)5508}$
7.	$53\overline{)2328}$	$38\overline{)269}$	$47\overline{)2872}$	$55\overline{)343}$	$46\overline{)2668}$
8.	$69\overline{)5589}$	$56\overline{)4196}$	$65\overline{)1825}$	$46\overline{)2669}$	$55\overline{)2665}$

Practice in dividing

1. Harry is sending away for some blueberry bushes for his garden. He saw this advertisement.

He said, "If I buy 10 bushes, they will cost me __?__¢ apiece; if I buy 25, they will cost __?__¢ apiece; but if I buy 50, they will cost only __?__¢ apiece."

Improved

BLUEBERRY BUSHES

10 FOR $1.20
25 FOR $2.25
50 FOR $4.00

POTTER'S NURSERIES
33 Elm Street, Pineville, New Hampshire

2. If Harry pays $3.00 for 25 raspberry bushes, the bushes will cost __?__¢ apiece.

In each of these divisions, (1) tell whether the quotient will be less than 10, between 10 and 100, or more than 100; (2) tell where you will write the first quotient figure; (3) estimate the first quotient figure. Then divide and check.

	a	b	c	d	e
3.	$8\overline{)3553}$	$6\overline{)2592}$	$8\overline{)728}$	$9\overline{)6480}$	$5\overline{)2735}$
4.	$9\overline{)8562}$	$7\overline{)791}$	$9\overline{)648}$	$6\overline{)2635}$	$7\overline{)2873}$
5.	$7\overline{)7021}$	$8\overline{)6456}$	$6\overline{)2466}$	$9\overline{)5672}$	$7\overline{)294}$
6.	$79\overline{)6454}$	$57\overline{)4737}$	$9\overline{)6372}$	$58\overline{)4139}$	$49\overline{)307}$
7.	$37\overline{)2350}$	$9\overline{)8195}$	$5\overline{)5027}$	$46\overline{)3852}$	$68\overline{)5802}$
8	$23\overline{)188}$	$26\overline{)1594}$	$37\overline{)2999}$	$28\overline{)1160}$	$48\overline{)3890}$
9.	$45\overline{)3465}$	$47\overline{)3958}$	$49\overline{)2799}$	$36\overline{)1847}$	$28\overline{)340}$
10.	$57\overline{)3848}$	$58\overline{)2765}$	$59\overline{)278}$	$52\overline{)3599}$	$56\overline{)1536}$
11.	$73\overline{)4975}$	$67\overline{)5762}$	$77\overline{)6475}$	$39\overline{)1989}$	$64\overline{)5696}$

How much do you know about division?

1. The town of Elmwood is having an Old Home Week parade.

$$\begin{array}{r} 8 \\ 45\overline{)380} \\ 360 \\ \hline 20 \end{array}$$

The 380 school children of Elmwood are to be in the parade. They will march in groups of 45.

How many groups of children will there be?

- Which number in the division above tells how many children will march in all?
- Which number tells how many will march in each group?
- Which number tells how many groups there will be?
- Which number tells how many children there will be in 8 groups?
- Which number tells how many extra children there will be? (These children are lucky. They will ride on a float.)
- Does the Hint System work in this division?

2. Twelve boys have 98 marbles they want to share equally.

$$\begin{array}{r} 8 \\ 12\overline{)98} \\ 96 \\ \hline 2 \end{array}$$

How does this division show that the best they can do is take 8 marbles apiece, and then let 2 boys each take an extra marble?

3. The fifth grade is giving an assembly on the school lawn. Four hundred chairs must be moved from the auditorium to seat the guests.

$$\begin{array}{r} 12 \\ 32\overline{)400} \\ 320 \\ \hline 80 \\ 64 \\ \hline 16 \end{array}$$

If the 32 children share equally the job of moving the chairs, how many chairs will each pupil have to carry?

Can you tell which of the statements below are true?

- Four hundred chairs cannot be divided so that each of 32 children will carry exactly the same number of chairs.
- If each of the 32 children carries exactly 10 chairs, there will be 80 of the 400 chairs remaining in the auditorium.
- Each of the children will have to carry just 12 chairs.
- Sixteen of the children will each have to carry one extra chair.

4. Twenty-five girls want to share equally 106 shells.

$$\begin{array}{r} 4 \\ 25\overline{)106} \\ 100 \\ \hline 6 \end{array}$$

How does this division show that the best they can do is take 4 shells apiece, and then let 6 girls each take an extra shell?

A division short cut

Patricia divided 442 by 34 and checked her work. Then she made an interesting discovery.

13	34
34)442	× 13
340	102
102	34
102	442

She found that all the numbers in her division and in her check were the same, except that:

- In the division when she multiplied 34 by 10, she wrote 340. Point to the 340 in the division.
- In the check when she multiplied 34 by 10, she wrote 34 and then left an empty space in ones place. Point to the "3 4 empty" in the check.

Hal said, "The 340 and the '3 4 empty' are really alike. In the division she could also leave an empty space in ones place instead of writing the zero."

Show that Hal is right.

1. Here is the division with the 10×34 written "3 4 empty." Do all the numbers in the division and the check match?

13	34
34)442	13
34	102
102	34
102	442

2. Explain these two ways of dividing 504 by 24:

Long way	Short way
21	21
24)504	24)504
480	48
24	24
24	24

How are they alike? How are they different? What does the "4 8 empty" in the short way mean? Which way do you like better?

Estimate each quotient. Then divide and check. Use the short way.

	a	b	c
3.	28)315	49)1064	34)423
4.	53)1187	13)185	21)1085
5.	45)3250	41)1279	54)4489
6.	28)1160	31)2049	61)5198
7.	41)578	42)3498	48)2990
8.	42)1389	54)4933	62)2734
9.	71)2911	35)809	26)835
10.	62)3286	43)2798	36)1944
11.	53)3872	26)632	35)1575
12.	42)1428	34)1499	27)1396

Holiday problems

1. The children in Miss Lane's class are making paper stars to hang on the classroom Christmas tree. They can cut 3 stars from one sheet of paper.

How many sheets of paper do they need for 48 stars?

2. Miss Lane asked Alice to take 25 envelopes from a box marked "608 Envelopes."

Alice counted out 25 and marked the number on the box to show that ___?___ envelopes were left.

3. In the closet are 20 boxes of paintbox fillers, each containing 25 fillers. There is also an opened box containing 15 fillers. How many fillers are there in all?

4. Miss Lane has 384 sheets of water-color paper to divide among 32 children. How many sheets of paper should each child receive?

5. Ed is making calendars for gifts. He uses a sheet of paper for each month in the year, and an extra sheet for the cover.

How many calendars can Ed make from 52 sheets of paper?

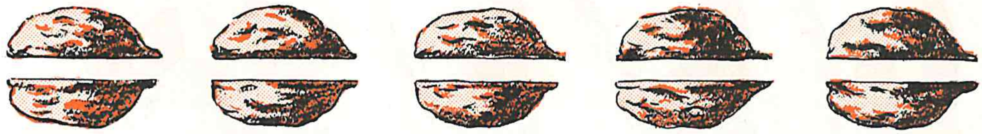
6. Miss Lane's pupils are making pine-cone candleholders. They have 26 pine cones. They have a dozen and a half candles.

How many more candles do they need in order to have one for each pine cone?

Visual aids in adding and subtracting halves and thirds. Adding and subtracting like fractions

UNIT 17

Adding and subtracting halves



The art class is using English walnut shells to make sailboats, turtles, and lapel pins. One-half a walnut shell is needed for each. The half shells are pictured above.

1. Count the half shells, saying $\frac{1}{2}$, $\frac{2}{2}$, $\frac{3}{2}$, $\frac{4}{2}$, and so on.

2. Count the shells by halves, saying $\frac{1}{2}$, 1, $1\frac{1}{2}$, 2, and so on.

3. Count the shells by halves, saying $\frac{1}{2}$, $\frac{2}{2}$ or 1, $\frac{3}{2}$ or $1\frac{1}{2}$, $\frac{4}{2}$ or 2, and so on.

4. How many half shells does Shirley need for a boat, a turtle, and a pin? $\frac{1}{2}+\frac{1}{2}+\frac{1}{2}=\frac{?}{2}$. Does $\frac{3}{2}=\frac{2}{2}+\frac{1}{2}$?

5. Use the shells to show that the improper fraction $\frac{3}{2}$ equals the mixed number $1\frac{1}{2}$. Then use them to show that the improper fraction $\frac{4}{2}$ equals the whole number 2.

6. Betty had $3\frac{1}{2}$ walnuts. Ellen gave her another $1\frac{1}{2}$. Do you know how many walnuts Betty had then?

3 walnuts + 1 walnut = ? nuts
$\frac{1}{2}$ walnut + $\frac{1}{2}$ walnut = ? nut
4 walnuts + 1 walnut = ? nuts

Use the picture above to help you do these additions:

	a	b	c
7.	$\frac{1}{2}+\frac{1}{2}$	$1\frac{1}{2}+\frac{1}{2}$	$3\frac{1}{2}+\frac{1}{2}$
8.	$1\frac{1}{2}+\frac{1}{2}$	$3\frac{1}{2}+1$	$3\frac{1}{2}+1\frac{1}{2}$
9.	$2\frac{1}{2}+\frac{1}{2}$	$4\frac{1}{2}+\frac{1}{2}$	$3\frac{1}{2}+2\frac{1}{2}$

10. Peter had 5 walnuts. He gave Helen $1\frac{1}{2}$ walnuts. Use the picture above to find how many he had left.

Use the picture above to help you do these subtractions:

	a	b	c
11.	$3-\frac{1}{2}$	$3-1\frac{1}{2}$	$3-2\frac{1}{2}$
12.	$3\frac{1}{2}-\frac{1}{2}$	$2-1\frac{1}{2}$	$5-\frac{1}{2}$
13.	$5-1\frac{1}{2}$	$5-3\frac{1}{2}$	$5-4\frac{1}{2}$
14.	$4-2\frac{1}{2}$	$5-2\frac{1}{2}$	$4-1\frac{1}{2}$
15.	$3\frac{1}{2}-1$	$3\frac{1}{2}-2$	$5-3\frac{1}{2}$

16. Rollo had \$4 in all. He spend $2\frac{1}{2}$ dollars for a camera and a roll of film. How much did he have left?

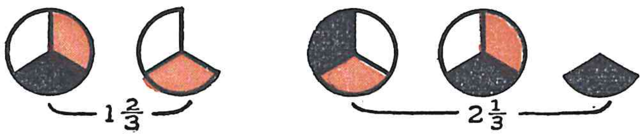
17. Marie bought a 5-pound bag of sugar. She used $1\frac{1}{2}$ lb. in making fudge. How much sugar was left in the bag?

To the Teacher: See Note 1 on page 310.

Adding and subtracting thirds

1. Ruth, Jane, Sue, and Alice have been asked to be midget cheerleaders at the high school football game next Saturday. The picture shows how they will dress. They are making their caps.

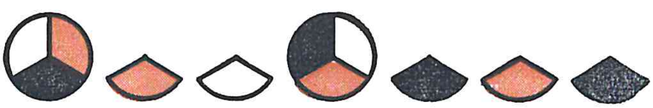
Ruth has knit $1\frac{2}{3}$ caps, and Alice has knit $2\frac{1}{3}$ caps. Do $1\frac{2}{3}$ caps and $2\frac{1}{3}$ caps $=$ 4 caps?



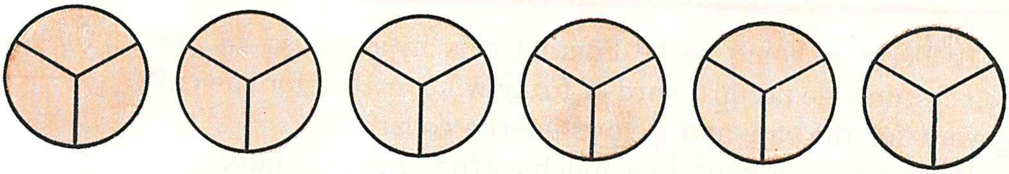
2. Ruth said, "Together, we have 3 whole caps finished. We'll have another as soon as I sew my $\frac{2}{3}$ cap and your $\frac{1}{3}$ cap together." Do you agree?

3. How many thirds do the girls need to make 1 cap? 2 caps? 5? 4? 6?

4. How many caps could you make from these?



Learning about thirds



1. Count the thirds: $\frac{1}{3}$, $\frac{2}{3}$, $\frac{3}{3}$, $\frac{4}{3}$, and so on.
2. Count by thirds: $\frac{1}{3}$, $\frac{2}{3}$, 1, $1\frac{1}{3}$, $1\frac{2}{3}$, and so on.
3. Count by thirds: $\frac{1}{3}$, $\frac{2}{3}$, $\frac{3}{3}$ or 1, $\frac{4}{3}$ or $1\frac{1}{3}$, $\frac{5}{3}$ or $1\frac{2}{3}$, and so on.

Use the circles above to help you find:

	a	b	c	d	e
4.	$2\frac{1}{3} + \frac{1}{3}$	$2\frac{1}{3} + \frac{2}{3}$	$2\frac{2}{3} + 1$	$2\frac{2}{3} + 1\frac{1}{3}$	$1 - \frac{2}{3}$
5.	$3 - \frac{1}{3}$	$4 - \frac{2}{3}$	$5 - 1\frac{1}{3}$	$6 - 5\frac{2}{3}$	$3 - 2\frac{2}{3}$
6.	$1\frac{2}{3} + \frac{2}{3}$	$1\frac{2}{3} + 1\frac{2}{3}$	$2\frac{1}{3} + 2\frac{1}{3}$	$\frac{5}{3} + \frac{4}{3}$	$4 - 2\frac{2}{3}$
7.	$\frac{2}{3} + 3\frac{2}{3}$	$3 - 2\frac{1}{3}$	$1\frac{1}{3} + 4$	$6 - \frac{1}{3}$	$5 - 1\frac{1}{3}$

8. Can you make a different diagram to help you find the answers in Exs. 4–7?

9. Marie needs $1\frac{1}{3}$ cups of milk for a salmon loaf and $2\frac{1}{3}$ cups of milk for a tapioca pudding.

There is a quart of milk that Marie may use. Will that be enough? (1 qt. = 4 cups)

10. Peter's recipe for making popcorn balls calls for $1\frac{2}{3}$ cups of molasses.

He has a quart of molasses. Has he enough to make two batches of popcorn balls?

11. Harold needs 6 yards of tape to bind a map. He has two pieces of tape, one $2\frac{2}{3}$ yards long and one $3\frac{2}{3}$ yards long. Has he enough?

12. Jim is making toy sailboats for Christmas presents. He bought 1 yard of sailcloth and used $\frac{1}{3}$ yard for sails on one boat.

Jim says he has $\frac{2}{3}$ yard left. Is he right?

13. Jim has a stick 2 feet long. If he uses $1\frac{1}{3}$ feet of it for the mast on a toy sailboat, how much will he have left?

Adding and subtracting fractions

1. Peter is going to be Santa Claus in a Christmas play. On his red costume he needs $\frac{1}{8}$ yard of fuzzy white cotton for the cuffs, $\frac{1}{8}$ yard for the cap, and $\frac{3}{8}$ yard for the collar.

Peter wants to know how much cotton he should buy.

1 eighth + 1 eighth + 3 eighths = _?_ eighths

$\frac{1}{8} + \frac{1}{8} + \frac{3}{8} = \frac{5}{8}$ may be written like this: →

$$\boxed{\begin{array}{r} \frac{1}{8} \\ \frac{1}{8} \\ \frac{3}{8} \\ \hline \frac{5}{8} \end{array}}$$

2. 3 hours + 4 hours = _?_ hours

3 eighths + 4 eighths = _?_ eighths. $\frac{3}{8} + \frac{4}{8} = \frac{?}{8}$

3. 5 inches − 3 inches = _?_ inches

5 eighths − 3 eighths = _?_ eighths

$\frac{5}{8} - \frac{3}{8} = \frac{2}{8}$ may be written this way: →

$$\boxed{\begin{array}{r} \frac{5}{8} \\ -\frac{3}{8} \\ \hline \frac{2}{8} \end{array}}$$

4. You may add hours to hours, quarts to quarts, or inches to inches because they are alike.

You may add eighths to eighths, sixths to sixths, or tenths to tenths because they are alike.

You may subtract inches from _?_; fifths from _?_; thirds from _?_.

5. Study Exs. 1–4. Then make up a rule for adding and subtracting fractions whose denominators are alike.

When you are adding or subtracting fractions, you add or subtract the *numerators*.

The *denominators* tell you the *name* and *size* of the pieces you are adding or subtracting.

3 pieces and 1 piece are 4 pieces

3 fifths and 1 fifth are 4 fifths

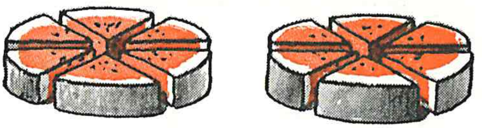
$\frac{3}{5} + \frac{1}{5} = \frac{4}{5}$

6. Use the rule you made in Ex. 5 to do these examples:

a	b	c	d	e	f	g	h	i	j
$\frac{5}{8}$	$\frac{5}{8}$	$\frac{6}{8}$	$\frac{6}{8}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{2}{5}$	$\frac{3}{10}$	$\frac{2}{6}$	$\frac{9}{10}$
$+\frac{1}{8}$	$-\frac{1}{8}$	$+\frac{1}{8}$	$-\frac{1}{8}$	$+\frac{1}{4}$	$-\frac{1}{4}$	$+\frac{1}{5}$	$+\frac{3}{10}$	$+\frac{2}{6}$	$-\frac{3}{10}$

Adding and subtracting fractions

1. Bud invited the swimming team to his house for some watermelon. He had 2 thick slices. He cut each slice into 6 equal pieces. How many sixths were there in 1 slice? in 2 slices?



2. There were 8 boys. Bud served $\frac{1}{6}$ of a slice to each. That took 8 sixths, which was 1 whole slice and ___?___ sixths of the second slice.

$$\frac{8}{6} = \frac{6}{6} + \frac{2}{6} = 1\frac{2}{6}$$

Use the drawing for Ex. 1 to help you with these exercises:

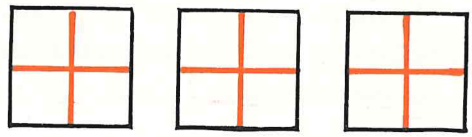
3. How many sixths do 4 sixths and 5 sixths equal? 9 sixths equals 1 whole and ___?___ sixths.

$\frac{4}{6} + \frac{5}{6} = \frac{9}{6}$ $\qquad$ $\frac{9}{6} = \frac{6}{6} + \frac{3}{6} = 1\frac{3}{6}$

4. How many sixths do 5 sixths and 5 sixths equal? $\frac{10}{6} = 1$ whole and ___?___ sixths.

$$\frac{5}{6} + \frac{5}{6} = \frac{10}{6} = 1\frac{?}{6}$$

5. How much would be left from 2 whole watermelon slices after $\frac{2}{6}$ of a slice was eaten? after $\frac{3}{6}$ was eaten? after $\frac{5}{6}$ was eaten? after 1 whole slice and $\frac{1}{6}$ of another slice were eaten? after $1\frac{3}{6}$ was eaten? $1\frac{5}{6}$?



Use the rectangles above to find the answers to Exs. 6–8.

6. $\frac{3}{4} + \frac{3}{4} + \frac{3}{4} = ?\frac{?}{4}$

7. $3 - \frac{3}{4} = ?\frac{?}{4}$

8. $\frac{2}{4} + \frac{2}{4} + \frac{2}{4} + \frac{2}{4} = \frac{?}{4} = ?$

Tell the missing numbers:

9. $\frac{2}{5} + \frac{3}{5} + \frac{3}{5} = \frac{?}{5} = 1\frac{?}{5}$

10. $\frac{3}{8} + \frac{2}{8} + \frac{5}{8} = \frac{?}{8} = 1\frac{?}{8}$

11. $\frac{5}{6} + \frac{5}{6} + \frac{1}{6} = \frac{?}{6} = ?\frac{?}{6}$

12. $\frac{2}{3} + \frac{2}{3} + \frac{2}{3} = \frac{?}{3} = ?$

Write the answers on folded paper:

	a	b	c	d
13.	$\frac{6}{8} - \frac{4}{8}$	$\frac{6}{7} - \frac{2}{7}$	$\frac{5}{9} + \frac{1}{9}$	$\frac{3}{2} - \frac{1}{2}$
14.	$\frac{3}{4} + \frac{1}{4}$	$\frac{4}{5} + \frac{2}{5}$	$\frac{5}{6} + \frac{1}{6}$	$\frac{9}{10} - \frac{5}{10}$

15. Jane baked two apple pies of the same size. She cut each pie into 6 equal servings.

She has 4 servings left on one pie pan and 3 left on the other.

Can she fit all of the pie that is left on one pie pan?

Written practice

1. Jane needs 8 dozen fig bars to serve at a party. Each package of fig bars contains 24 bars. How many packages should she buy?

2. Earl has 200 marbles. If he divides them equally among 8 boys, each boy will receive __?__ marbles.

3. Can you tell how much change Doris will receive from \$2.00 after buying $\frac{7}{8}$ of a yard of silk at 64¢ a yard?

4. Jack has a piece of rope 10 feet long. If he cuts off $5\frac{1}{2}$ feet to tie his boat to a wharf, he will have __?__ feet left.

5. At the rate of 40 miles an hour, how many hours will a bus have to travel to cover 960 miles?

6. Irvin bought 8 holly wreaths for \$2.80. "The wreaths cost __?__ apiece," he said.

7. The Reeds made a 396-mile trip in 12 hours. How many miles did they travel in 1 hour on the average?

8. Find the cost of 28 yards of red, white, and blue streamers at \$.19 a yard.

9. Find the average of 24, 63, 48, 39, and 52.

10. Find the difference between \$60.37 and \$10.72.

11. How much more than \$65 is \$824.25?

12. What is the product of 248 and 306?

13. If 50 is the divisor and 250 the dividend, what is the quotient?

14. If 10 is the divisor and 42 is the quotient, how do you find the dividend?

15.	**16.**	**17.**	**18.**	**19.**
68	46	55	60	56
69	92	86	37	89
98	66	96	10	75
84	99	98	72	97
77	78	69	56	46

20. $9\overline{)5787}$ **21.** $13\overline{)143}$ **22.** $65\overline{)3449}$ **23.** $50\overline{)1971}$

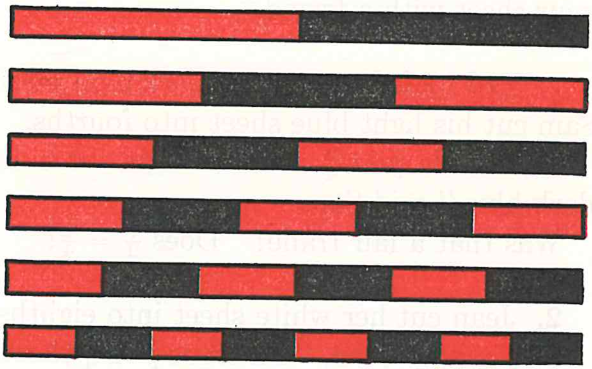
Comparing fractions. Changing to equal fractions with larger denominators. Adding and subtracting unlike fractions

UNIT 18

Which is more?

Which of the two fractional parts of each pair in Exs. 1–6 is larger? The diagram will help you.

	a	b
1.	$\frac{1}{3}$ or $\frac{1}{2}$	$\frac{2}{3}$ or $\frac{3}{4}$
2.	$\frac{1}{2}$ or $\frac{2}{3}$	$\frac{2}{3}$ or $\frac{5}{6}$
3.	$\frac{1}{3}$ or $\frac{1}{5}$	$\frac{1}{4}$ or $\frac{1}{5}$
4.	$\frac{1}{2}$ or $\frac{1}{4}$	$\frac{3}{6}$ or $\frac{1}{8}$
5.	$\frac{3}{4}$ or $\frac{3}{5}$	$\frac{4}{5}$ or $\frac{5}{6}$
6.	$\frac{3}{6}$ or $\frac{3}{8}$	$\frac{3}{4}$ or $\frac{7}{8}$



7. Is $\frac{2}{3}$ cup of milk more or less than $\frac{3}{4}$ cup?

8. Ann spent $1\frac{3}{4}$ hours making candy. Shirley spent $1\frac{1}{2}$ hours. Which girl spent the longer time?

9. Jim is $42\frac{1}{2}$ inches tall. Al is $42\frac{3}{4}$ inches tall. Who is taller?

10. Use your ruler to draw a line $\frac{3}{4}$ inch long and a line $\frac{5}{8}$ inch long. Which is longer?

11. How many inches are there in $\frac{2}{3}$ yard? in $\frac{3}{4}$ yard? Which is more, $\frac{2}{3}$ or $\frac{3}{4}$?

12. Find $\frac{2}{3}$ of 12. Find $\frac{3}{4}$ of 12. Which is larger?

13. Find $\frac{3}{5}$ of 20. Find $\frac{3}{4}$ of 20. Which is larger?

14. Find $\frac{3}{8}$ of 24. Find $\frac{3}{4}$ of 24. Which is larger?

15. Shirley wants to make a coat for her big doll. The pattern calls for $1\frac{1}{4}$ yards of flannel.

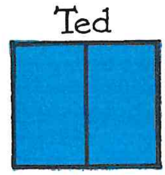
On the bargain table she found a remnant marked $1\frac{1}{3}$ yards. Is the remnant long enough to make the coat?

16. The Globe Store sells 5 pairs of "No-Hole" socks for \$4. Each pair sells for $\frac{1}{5}$ of \$4, or what part of a dollar?

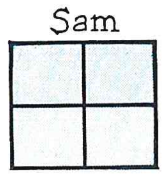
The Variety Store sells 6 pairs of "No-Hole" socks for \$5. Each pair sells for $\frac{1}{6}$ of \$5, or what part of a dollar?

Which store offers the better bargain on "No-Hole" socks? Use the diagram. Which is more: $\frac{4}{5}$ or $\frac{5}{6}$?

Equal fractions



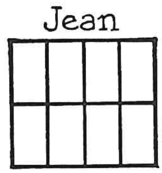
"Each of you may have a sheet of paper to make animal cutouts," said Miss Wall. "If you wish to have sheets of different colors, you may trade part of your sheet with a friend."



1. Ted folded and cut his dark blue sheet into halves. Sam cut his light blue sheet into fourths.

"I'll trade you $\frac{2}{4}$ sheet of light blue for $\frac{1}{2}$ sheet of dark blue," said Sam.

Was that a fair trade? Does $\frac{1}{2} = \frac{2}{4}$?

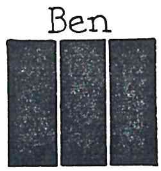


2. Jean cut her white sheet into eighths.

Sam said to Jean, "I'll trade you $\frac{1}{4}$ sheet of light blue for $\frac{2}{8}$ sheet of white."

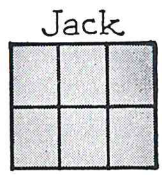
Was that a fair trade? Does $\frac{1}{4} = \frac{2}{8}$?

3. Does $\frac{1}{2} = \frac{2}{4} = \frac{4}{8}$?

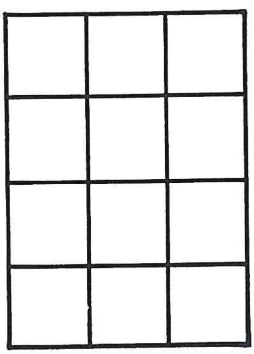


4. Ben cut his black sheet into thirds. Jack cut his gray sheet into sixths. How many sixths should Jack trade for a third? for 2 thirds?

$\frac{1}{3} = \frac{?}{6}$. $\frac{2}{3} = \frac{?}{6}$.



5. How many sixths should Jack trade for a half? $\frac{1}{2} = \frac{?}{6}$.



6. This rectangle is divided into _?_ equal parts.

- Each part is $\frac{?}{12}$ of the rectangle.
- Show that $\frac{1}{2}$ of the rectangle $= \frac{6}{12}$ of the rectangle.
- Show that $\frac{1}{3}$ of the rectangle $= \frac{4}{12}$ of the rectangle.
- Show that $\frac{1}{4}$ of the rectangle $= \frac{3}{12}$ of the rectangle.
- Show that $\frac{1}{6}$ of the rectangle $= \frac{2}{12}$ of the rectangle.
- Show that $\frac{2}{3}$ of the rectangle $= \frac{8}{12}$ of the rectangle.
- Show that $\frac{3}{4}$ of the rectangle $= \frac{9}{12}$ of the rectangle.

7. Sally said, "I practiced $\frac{1}{2}$ hour this morning and $\frac{1}{2}$ hour this afternoon. That's an hour in all."

Do two $\frac{1}{2}$ hours equal 1 whole hour? Does $\frac{2}{2} = 1$?

8. What part of an hour does Sally practice if she practices $\frac{1}{4}$ hour in the morning and $\frac{1}{4}$ hour in the afternoon? $\frac{2}{4} = \frac{?}{2}$.

9. David asked for $\frac{1}{2}$ pound of butter. How many $\frac{1}{4}$-pound sticks should the clerk give him? $\frac{1}{2} = \frac{?}{4}$.

10. "Can you change half a dollar?" asked Mother.

"Yes," answered Jean, "here are __?__ quarters."

11. Brenda went to the store to buy $\frac{1}{2}$ pound of salted peanuts. The peanuts are put up only in $\frac{1}{8}$-pound packages. How many packages should she buy? $\frac{1}{2} = \frac{?}{8}$.

12. How many packages of peanuts should Brenda (Ex. 11) buy if she wants to have $\frac{1}{4}$ lb. of peanuts? $\frac{1}{4} = \frac{?}{8}$.

13. How many packages of peanuts should Brenda (Ex. 11) buy if she wants 1 lb.?

14. Draw lines with your ruler to prove that:

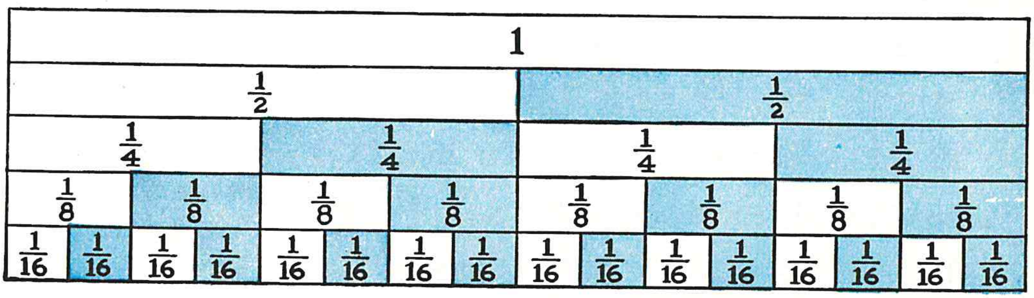
$\frac{1}{2}$ in. $= \frac{2}{4}$ in.	1 in. $= \frac{2}{2}$ in.
$\frac{1}{4}$ in. $= \frac{2}{8}$ in.	1 in. $= \frac{4}{4}$ in.
$\frac{3}{4}$ in. $= \frac{6}{8}$ in.	1 in. $= \frac{8}{8}$ in.

15. If you take music lessons, you have learned that:

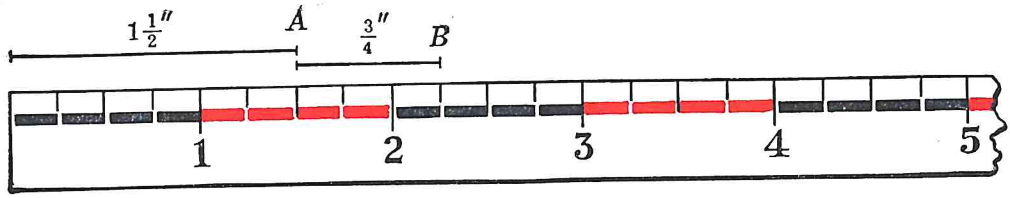
- a quarter note = __?__ eighth notes.
- a half note = __?__ quarter notes.
- an eighth note = __?__ sixteenth notes.
- a whole note = __?__ sixteenth notes.

16. What other discoveries about fractions have you learned from your music?

17. Miss Lane's class discovered 22 pairs of equal fractions on the diagram below. How many can you find?



Fractions and the ruler



1. Albert uses his ruler to add fractions. To add $1\frac{1}{2}$ and $\frac{3}{4}$, he looks at the $1\frac{1}{2}$-inch mark (at A) and counts forward $\frac{3}{4}$ to B.

He sees that B is on the $2\frac{1}{4}$-inch mark. He thinks, "$1\frac{1}{2} + \frac{3}{4} = 2\frac{1}{4}$." Is he right?

Use your ruler to help you find:

	a	*b*	*c*
2.	$1\frac{1}{2} + \frac{1}{2}$	$1\frac{3}{4} + \frac{1}{2}$	$1\frac{3}{4} + \frac{3}{4}$
3.	$1\frac{3}{4} + \frac{1}{4}$	$1\frac{1}{2} + \frac{3}{4}$	$1\frac{1}{2} + 1\frac{1}{2}$
4.	$1\frac{1}{4} + 1$	$1\frac{1}{4} + 1\frac{1}{4}$	$1\frac{3}{4} + 1\frac{1}{4}$
5.	$1\frac{3}{4} + 2$	$1\frac{1}{4} + 1\frac{3}{4}$	$1\frac{1}{2} + 2\frac{1}{2}$

6. Albert also uses his ruler to subtract. To find $2\frac{1}{4} - \frac{3}{4}$, he looks at the $2\frac{1}{4}$-inch mark (at B) and counts backward $\frac{3}{4}$ inches to A. He sees that $2\frac{1}{4} - \frac{3}{4} = \underline{\ ?\ }$.

Use a ruler to help you find:

	a	*b*	*c*
7.	$1\frac{1}{4} - \frac{1}{4}$	$3\frac{1}{2} - 1\frac{3}{4}$	$3 - \frac{1}{8}$
8.	$1\frac{1}{2} - \frac{3}{4}$	$3\frac{1}{4} - 1\frac{1}{4}$	$3 - 2\frac{1}{4}$
9.	$3\frac{1}{8} - \frac{1}{4}$	$3\frac{1}{4} - 1\frac{1}{2}$	$3 - 2\frac{1}{8}$
10.	$3\frac{1}{4} - 1$	$3\frac{1}{4} - 2\frac{3}{4}$	$2 - 1\frac{1}{4}$

11. May is in school $3\frac{1}{2}$ hr. each morning and $1\frac{1}{2}$ hr. each afternoon. How many hours a day is she in school? Use a clock to prove your answer.

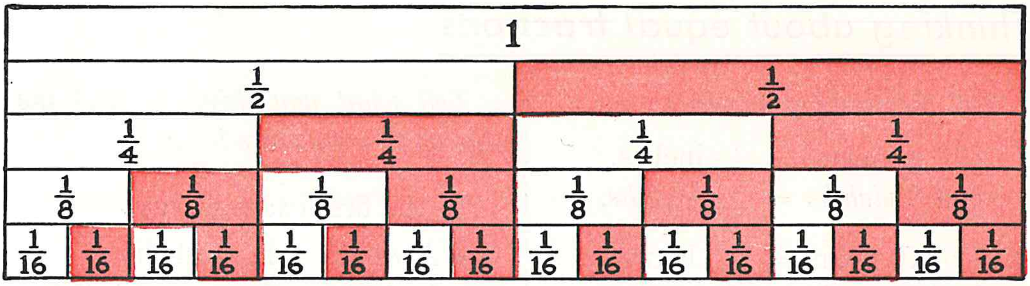
12. $2\frac{1}{2}$ yd. is how much longer than $1\frac{3}{4}$ yd.? Draw lines on the blackboard to prove your answer. Use a yardstick.

13. Tim has $2\frac{1}{2}$ dollars. He wants to buy cowboy boots that cost 6 dollars. How much more money does he need? Use toy money to prove your answer.

14. If you cut $\frac{3}{4}$ yd. from $3\frac{1}{4}$ yd. of ribbon, you will have $\underline{\ ?\ }$ yd. left. Make a blackboard drawing to prove your answer.

15. If you spend $\$2\frac{1}{2}$ out of $10, will you have left $\$8\frac{1}{2}$ or $\$7\frac{1}{2}$? Use toy money to prove your answer.

16. If you spend $\$3\frac{1}{4}$ out of $5, will you have left $\$2\frac{3}{4}$ or $\$1\frac{3}{4}$? Use toy money to prove your answer.



Adding and subtracting fractions

Lucy was making some new clothes for her puppet, Jocko. She needed $\frac{1}{2}$ yard of gingham for a suit and $\frac{1}{4}$ yard for a jacket. She wondered, "How much gingham is $\frac{1}{2}$ yard and $\frac{1}{4}$ yard?"

Lucy looked at the chart at the top of the page and thought, "One half is two fourths; two fourths and one fourth are three fourths. I will need $\frac{3}{4}$ yard of gingham to make Jocko's new suit and jacket."

With the help of the chart do these exercises:

	a	b	c	d
1.	$\frac{1}{2} = \frac{?}{4}$	$\frac{1}{2} = \frac{?}{8}$	$\frac{1}{4} = \frac{?}{8}$	$\frac{3}{4} = \frac{?}{8}$
2.	$\frac{1}{2} + \frac{1}{4} = \frac{?}{4}$	$\frac{1}{2} + \frac{1}{8} = \frac{?}{8}$	$\frac{1}{4} + \frac{1}{8} = \frac{?}{8}$	$\frac{1}{2} + \frac{3}{8} = \frac{?}{8}$
3.	$\frac{1}{4} + \frac{3}{8} = \frac{?}{8}$	$\frac{1}{4} + \frac{5}{8} = \frac{?}{8}$	$\frac{3}{4} + \frac{1}{8} = \frac{?}{8}$	$\frac{1}{2} + \frac{1}{2} = \frac{?}{2}$
4.	$\frac{3}{4} - \frac{1}{2} = \frac{?}{4}$	$\frac{1}{2} - \frac{5}{16} = \frac{?}{16}$	$\frac{1}{4} - \frac{1}{8} = \frac{?}{8}$	$\frac{1}{2} - \frac{3}{16} = \frac{?}{16}$
5.	$\frac{3}{8} - \frac{1}{4} = \frac{?}{8}$	$\frac{1}{8} - \frac{1}{16} = \frac{?}{16}$	$\frac{3}{4} - \frac{3}{8} = \frac{?}{8}$	$\frac{3}{8} - \frac{3}{16} = \frac{?}{16}$
6.	$\frac{1}{2} - \frac{1}{8} = \frac{?}{8}$	$\frac{1}{4} - \frac{1}{16} = \frac{?}{16}$	$\frac{5}{8} - \frac{1}{4} = \frac{?}{8}$	$\frac{3}{4} - \frac{5}{16} = \frac{?}{16}$
7.	$\frac{5}{8} - \frac{1}{2} = \frac{?}{8}$	$\frac{1}{2} - \frac{7}{16} = \frac{?}{16}$	$\frac{1}{2} - \frac{3}{8} = \frac{?}{8}$	$\frac{9}{16} - \frac{1}{2} = \frac{?}{16}$
8.	$\frac{1}{2} - \frac{1}{4} = \frac{?}{4}$	$\frac{3}{4} - \frac{7}{16} = \frac{?}{16}$	$\frac{7}{8} - \frac{1}{4} = \frac{?}{8}$	$\frac{7}{8} - \frac{1}{2} = \frac{?}{8}$

To the Teacher: See Note 6 on page 310.

Thinking about equal fractions

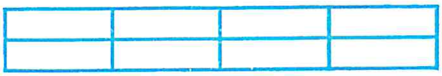
Tell the missing numbers:

1. $\frac{1}{2}$ of 8 inches = _?_ inches.
   $\frac{1}{2}$ of 8 *eighths* = _?_ *eighths.*

2. $\frac{1}{5}$ of 10 hours = _?_ hours.
   $\frac{1}{5}$ of 10 *tenths* = _?_ *tenths.*

3. $\frac{1}{4}$ of 12 gallons = _?_ gallons.
   $\frac{1}{4}$ of 12 *twelfths* = _?_ *twelfths.*

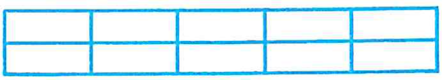
4.



This whole rectangle is divided into _?_ equal parts.

- A whole = $\boxed{8}$ eighths.
- A half = $\boxed{\frac{1}{2} \text{ of } 8}$ eighths = $\boxed{4}$ eighths. $\frac{1}{2} = \frac{?}{8}$.

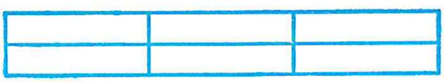
5.



This whole rectangle is divided into _?_ equal parts.

- A whole = 10 tenths.
- One fifth = $\frac{1}{5}$ of 10 tenths, or _?_ tenths. $\frac{1}{5} = \frac{?}{10}$.
- One half = $\frac{1}{2}$ of 10 tenths, or _?_ tenths. $\frac{1}{2} = \frac{?}{10}$.

6.



- A whole = _?_ sixths.
- A half = $\frac{1}{2}$ of 6 sixths = _?_ sixths. $\frac{1}{2} = \frac{?}{6}$.
- A third = _?_ sixths. $\frac{1}{3} = \frac{?}{6}$.

Tell what you think to find the missing numerators below.

In the first example say:

- A whole = 12 twelfths
- $\frac{1}{4}$ of 12 twelfths = 3 twelfths
- So $\frac{1}{4} = \frac{3}{12}$.

7. $\frac{1}{4} = \frac{?}{12}$ $\quad \frac{1}{4} = \frac{?}{16}$ $\quad \frac{1}{3} = \frac{?}{12}$

8. $\frac{1}{2} = \frac{?}{12}$ $\quad \frac{1}{6} = \frac{?}{12}$ $\quad \frac{1}{2} = \frac{?}{16}$

9. $\frac{1}{2} = \frac{?}{8}$ $\quad \frac{1}{3} = \frac{?}{6}$ $\quad \frac{1}{2} = \frac{?}{6}$

10. $\frac{1}{4} = \frac{?}{8}$ $\quad \frac{1}{2} = \frac{?}{10}$ $\quad \frac{1}{5} = \frac{?}{10}$

11. To change $\frac{3}{8}$ to sixteenths, think and say:

- A whole = 16 sixteenths.
- $\frac{1}{8} = \frac{1}{8}$ of 16 sixteenths = 2 sixteenths ($\frac{2}{16}$).
- $\frac{3}{8} = 3 \times 2$ sixteenths = 6 sixteenths ($\frac{6}{16}$). $\frac{3}{8} = \frac{?}{16}$.

Tell what you think when you find the missing numerators in the following examples:

12. $\frac{3}{4} = \frac{?}{16}$ $\quad \frac{2}{5} = \frac{?}{10}$ $\quad \frac{1}{8} = \frac{?}{16}$

13. $\frac{2}{6} = \frac{?}{12}$ $\quad \frac{2}{3} = \frac{?}{12}$ $\quad \frac{7}{8} = \frac{?}{16}$

14. $\frac{3}{6} = \frac{?}{12}$ $\quad \frac{4}{5} = \frac{?}{10}$ $\quad \frac{3}{5} = \frac{?}{10}$

15. $\frac{5}{6} = \frac{?}{12}$ $\quad \frac{2}{3} = \frac{?}{6}$ $\quad \frac{3}{4} = \frac{?}{12}$

16. $\frac{5}{8} = \frac{?}{16}$ $\quad \frac{3}{8} = \frac{?}{16}$ $\quad \frac{4}{6} = \frac{?}{12}$

Changing and adding fractions

Bob's mother is making him a duffel bag and a knapsack. She needs $\frac{3}{4}$ yard of canvas for the duffel bag and $\frac{3}{8}$ yard for the knapsack. Use a yardstick to find out how much canvas she should buy in all.

You cannot add fractions unless their denominators are alike. What will you have to do to the $\frac{3}{4}$ before you can add $\frac{3}{8}$ to it?

Think, "$\frac{3}{4} = \frac{?}{8}$; $\frac{6}{8} + \frac{3}{8} = \frac{9}{8} = 1\frac{1}{8}$"

This is a good way to write the addition: →

$$\begin{array}{r} \frac{3}{4} = \frac{6}{8} \\ \frac{3}{8} = \frac{3}{8} \\ \hline \frac{9}{8} = 1\frac{1}{8} \end{array}$$

It shows that Bob's mother needs __?__ yards of canvas.

Tell how the fractions in these examples must be changed before they can be added. Then add.

	a	b	c	d	e	f	g	h
1.	$\frac{1}{3}$ $\frac{1}{6}$	$\frac{3}{8}$ $\frac{1}{4}$	$\frac{3}{8}$ $\frac{1}{2}$	$\frac{5}{8}$ $\frac{1}{4}$	$\frac{2}{5}$ $\frac{1}{10}$	$\frac{3}{5}$ $\frac{3}{10}$	$\frac{3}{4}$ $\frac{1}{8}$	$\frac{1}{6}$ $\frac{5}{12}$
2.	$\frac{1}{5}$ $\frac{1}{10}$ $\frac{3}{5}$	$\frac{1}{12}$ $\frac{5}{12}$ $\frac{1}{3}$	$\frac{7}{12}$ $\frac{1}{6}$ $\frac{1}{6}$	$\frac{1}{12}$ $\frac{1}{4}$ $\frac{7}{12}$	$\frac{1}{6}$ $\frac{1}{3}$ $\frac{1}{3}$	$\frac{1}{6}$ $\frac{1}{2}$ $\frac{1}{6}$	$\frac{1}{10}$ $\frac{3}{10}$ $\frac{1}{2}$	$\frac{3}{8}$ $\frac{1}{4}$ $\frac{1}{8}$
3.	$\frac{1}{12}$ $\frac{1}{3}$ $\frac{1}{4}$	$\frac{1}{8}$ $\frac{1}{4}$ $\frac{1}{2}$	$\frac{1}{10}$ $\frac{1}{5}$ $\frac{1}{2}$	$\frac{1}{6}$ $\frac{1}{12}$ $\frac{1}{2}$	$\frac{3}{8}$ $\frac{1}{4}$ $\frac{1}{16}$	$\frac{3}{10}$ $\frac{1}{5}$ $\frac{2}{5}$	$\frac{5}{12}$ $\frac{1}{3}$ $\frac{1}{6}$	$\frac{1}{8}$ $\frac{3}{16}$ $\frac{1}{2}$

Add these fractions. If the answer is an improper fraction, change it to a whole or a mixed number.

	a	b	c	d	e	f	g	h
4.	$\frac{1}{2}$ $\frac{1}{3}$ $\frac{1}{6}$	$\frac{5}{8}$ $\frac{1}{4}$ $\frac{1}{2}$	$\frac{5}{8}$ $\frac{3}{16}$ $\frac{1}{4}$	$\frac{2}{3}$ $\frac{1}{6}$ $\frac{7}{12}$	$\frac{2}{3}$ $\frac{5}{6}$ $\frac{1}{2}$	$\frac{5}{16}$ $\frac{1}{4}$ $\frac{5}{8}$	$\frac{1}{12}$ $\frac{5}{6}$ $\frac{2}{3}$	$\frac{1}{2}$ $\frac{5}{8}$ $\frac{5}{16}$

5. Does $\frac{3}{4} + \frac{7}{8} + \frac{9}{16} = \frac{12}{16} + \frac{14}{16} + \frac{9}{16} = \frac{12 + 14 + 9}{16} = \frac{35}{16} = 2\frac{3}{16}$?

Changing and subtracting fractions

Jean has $\frac{3}{4}$ yard of lace. If she uses $\frac{1}{2}$ yard, how much will she have left?

Show on a yardstick how Jean worked this problem. Then explain how she wrote it here:

$$\begin{array}{rcr} \frac{3}{4} & = & \frac{3}{4} \\ -\frac{1}{2} & = & \frac{2}{4} \\ \hline & & \frac{1}{4} \end{array}$$

In subtracting fractions, do you see that you sometimes have to change them so that the denominators are alike, just as you sometimes have to do when you add fractions? To subtract $\frac{1}{2}$ from $\frac{3}{4}$, Jean changed the $\frac{1}{2}$ to $\frac{2}{4}$.

Tell how the fractions in these subtractions must be changed before you can subtract. Then copy and subtract.

	a	b	c	d	e	f
1.	$\begin{array}{c}\frac{7}{8}\\ \frac{1}{4}\\ \hline\end{array}$	$\begin{array}{c}\frac{3}{4}\\ \frac{5}{8}\\ \hline\end{array}$	$\begin{array}{c}\frac{11}{12}\\ \frac{1}{6}\\ \hline\end{array}$	$\begin{array}{c}\frac{7}{16}\\ \frac{1}{4}\\ \hline\end{array}$	$\begin{array}{c}\frac{9}{16}\\ \frac{1}{2}\\ \hline\end{array}$	$\begin{array}{c}\frac{7}{12}\\ \frac{1}{4}\\ \hline\end{array}$
2.	$\begin{array}{c}\frac{7}{10}\\ \frac{1}{2}\\ \hline\end{array}$	$\begin{array}{c}\frac{5}{8}\\ \frac{1}{2}\\ \hline\end{array}$	$\begin{array}{c}\frac{9}{10}\\ \frac{1}{5}\\ \hline\end{array}$	$\begin{array}{c}\frac{7}{8}\\ \frac{1}{2}\\ \hline\end{array}$	$\begin{array}{c}\frac{5}{6}\\ \frac{1}{3}\\ \hline\end{array}$	$\begin{array}{c}\frac{3}{8}\\ \frac{1}{4}\\ \hline\end{array}$
3.	$\begin{array}{c}\frac{5}{8}\\ \frac{1}{16}\\ \hline\end{array}$	$\begin{array}{c}\frac{5}{9}\\ \frac{1}{3}\\ \hline\end{array}$	$\begin{array}{c}\frac{5}{12}\\ \frac{1}{3}\\ \hline\end{array}$	$\begin{array}{c}\frac{2}{3}\\ \frac{5}{12}\\ \hline\end{array}$	$\begin{array}{c}\frac{5}{6}\\ \frac{1}{2}\\ \hline\end{array}$	$\begin{array}{c}\frac{7}{8}\\ \frac{3}{4}\\ \hline\end{array}$

In each pair of fractions tell which is larger. It is easy, if you change the fractions so that they have denominators that are alike.

	a	b	c	d	e	f
4.	$\frac{5}{12}$ $\frac{1}{2}$	$\frac{3}{8}$ $\frac{3}{4}$	$\frac{5}{6}$ $\frac{1}{2}$	$\frac{5}{12}$ $\frac{1}{3}$	$\frac{7}{16}$ $\frac{5}{8}$	$\frac{2}{3}$ $\frac{5}{6}$

In each pair of fractions subtract the smaller from the larger.

5.	$\frac{3}{4}$ $\frac{7}{8}$	$\frac{2}{5}$ $\frac{3}{10}$	$\frac{2}{12}$ $\frac{1}{6}$	$\frac{7}{12}$ $\frac{1}{2}$	$\frac{5}{8}$ $\frac{3}{4}$	$\frac{2}{3}$ $\frac{5}{6}$
6.	$\frac{1}{4}$ $\frac{1}{12}$	$\frac{5}{12}$ $\frac{1}{4}$	$\frac{3}{4}$ $\frac{7}{12}$	$\frac{9}{16}$ $\frac{1}{2}$	$\frac{11}{12}$ $\frac{5}{6}$	$\frac{3}{8}$ $\frac{5}{16}$
7.	$\frac{5}{12}$ $\frac{1}{2}$	$\frac{7}{8}$ $\frac{1}{2}$	$\frac{9}{16}$ $\frac{3}{8}$	$\frac{7}{12}$ $\frac{1}{3}$	$\frac{3}{8}$ $\frac{1}{4}$	$\frac{1}{10}$ $\frac{1}{5}$
8.	$\frac{5}{6}$ $\frac{1}{3}$	$\frac{3}{4}$ $\frac{5}{12}$	$\frac{5}{8}$ $\frac{1}{2}$	$\frac{11}{16}$ $\frac{3}{4}$	$\frac{3}{10}$ $\frac{3}{5}$	$\frac{11}{12}$ $\frac{3}{4}$

Sharing the expense of a party

Alice, Betty, and Ruth gave a party for 16 girls.

1. Alice bought paper plates, paper cups, paper napkins, and paper candy-baskets.

Look at the picture and then figure out how much Alice spent. Remember she had to buy enough for 16 persons. (Save your answer.)

2. Betty bought flowers for the table. She decided to get:

- $\frac{1}{2}$ doz. yellow chrysanthemums at 90¢ a dozen.
- $\frac{1}{2}$ doz. asters at 60¢ a dozen.

How much did Betty spend? (Save your answer.)

3. Ruth bought:

- 3 bottles ginger ale at 25¢ a bottle.
- 2 qt. ice cream at 76¢ a quart.
- 4 doz. cookies at 35¢ a dozen.
- $1\frac{1}{2}$ lb. peanuts at 40¢ a pound.

How much did Ruth spend?

4. How much did the girls spend in all? If they share the cost equally, each girl's share is __?__.

5. Which girls spent less than their share? Which one spent more than her share?

6. How much does Alice owe Ruth? How much does Betty owe Ruth?

Reducing fractions

1. George was looking at the equal fractions on his ruler.

$$\frac{8}{16} = \frac{4}{8} = \frac{2}{4} = \frac{1}{2}$$

He said, "I really don't need a ruler or diagram to tell that $\frac{8}{16}$ is equal to $\frac{1}{2}$.

"I can divide both the numerator and the denominator by 8 and get $\frac{8}{16} = \frac{8 \div 8}{16 \div 8} = \frac{1}{2}$. I wonder if I can do that with any fraction." What do you think?

2. Then George tried this idea on the fraction $\frac{3}{6}$. He divided both the numerator and the denominator by _?_ and decided that $\frac{3}{6} = \frac{3 \div 3}{6 \div 3} = \frac{1}{2}$.

Was he right? Can you make a drawing to show that $\frac{3}{6} = \frac{1}{2}$?

3. George then tried his idea on the fraction $\frac{12}{16}$. He saw on his ruler that $\frac{12}{16}$ was equal to $\frac{3}{4}$.

If he divided the numerator and the denominator of $\frac{12}{16}$ by _?_, he would get $\frac{3}{4}$. So $\frac{12}{16}$ is equal to $\frac{3}{4}$.

4. George then tried his idea (of changing a fraction to an equal fraction by dividing both its numerator and denominator by 2, or 3, or 4) on the fraction $\frac{7}{8}$.

Why didn't his idea work with the fraction $\frac{7}{8}$?

5. Here are two ways to change $\frac{12}{16}$ to an equal fraction:

- $\frac{12 \div 2}{16 \div 2} = \frac{6}{8}$
- $\frac{12 \div 4}{16 \div 4} = \frac{3}{4}$

Are both answers correct? Is the second answer better? Why?

When you have changed a fraction so that it has the smallest numbers it can have in the numerator and the denominator, we say you have *reduced the fraction to lowest terms.* Always reduce fractional answers to lowest terms.

6. $\frac{2}{4}$ is reduced to $\frac{1}{2}$ by dividing the numerator, 2, and the denominator, 4, by _?_.

7. How is $\frac{6}{8}$ reduced to $\frac{3}{4}$? $\frac{4}{6}$ reduced to $\frac{2}{3}$? $\frac{4}{10}$ reduced to $\frac{2}{5}$?

Reduce the fractions that are not in lowest terms:

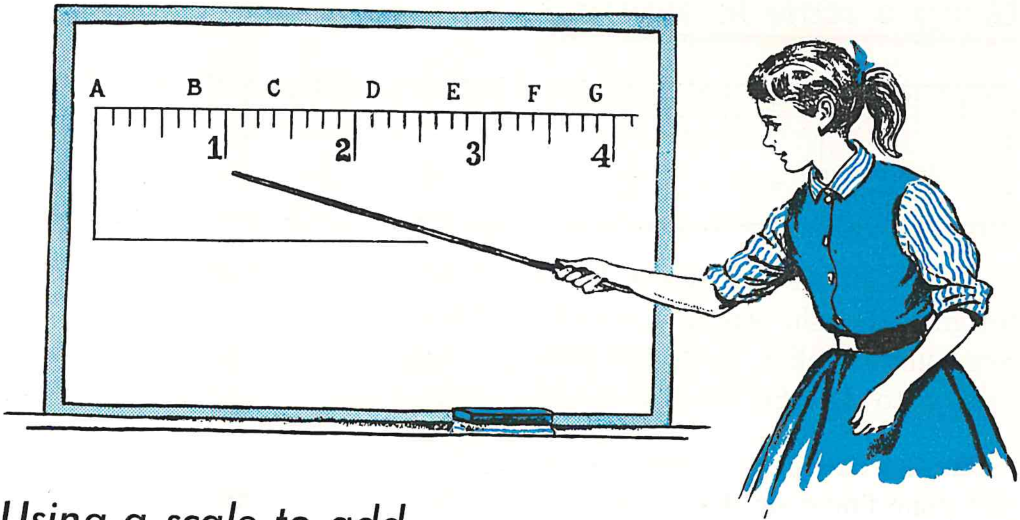
8. $\frac{5}{8}$ $\quad \frac{6}{8}$ $\quad \frac{6}{10}$ $\quad \frac{4}{8}$ $\quad \frac{9}{10}$

9. $\frac{9}{12}$ $\quad \frac{8}{12}$ $\quad \frac{5}{16}$ $\quad \frac{4}{16}$ $\quad \frac{6}{16}$

Reduce answers to lowest terms:

10. $\frac{1}{6} + \frac{1}{6}$ $\quad \frac{1}{8} + \frac{1}{4}$ $\quad \frac{1}{2} + \frac{1}{6}$ $\quad \frac{1}{5} + \frac{3}{10}$ $\quad \frac{3}{8} + \frac{1}{8}$

11. Is the value of a fraction changed by dividing both its numerator and its denominator by the same number? Illustrate.



Using a scale to add

Miss Blaine's pupils use a fraction scale like the one above to help them with their arithmetic.

1. The letter B is on the $\frac{3}{4}$ mark.
C is on the ___?___ mark.
F is on the ___?___ mark.

2. What letter is on the $2\frac{1}{8}$ mark? the $3\frac{7}{8}$ mark?

3. If you start at letter A and count $1\frac{3}{8}$, you stop at ___?___.

4. If you start at letter B and count $1\frac{1}{4}$, you stop at ___?___.

5. From B to C is ___?___; from D to E is ___?___.

6. To add $1\frac{3}{8}$ and $\frac{5}{8}$, begin at $1\frac{3}{8}$ (C) and count forward $\frac{5}{8}$.
You stop at ___?___. $1\frac{3}{8} + \frac{5}{8} =$ ___?___.

7. To add $2\frac{1}{8} + \frac{7}{8}$, begin at $2\frac{1}{8}$ (D) and count forward $\frac{7}{8}$.
You stop at ___?___. $2\frac{1}{8} + \frac{7}{8} =$ ___?___.

8. To add $2\frac{3}{4} + \frac{3}{8}$, begin at $2\frac{3}{4}$ (E) and count forward $\frac{3}{8}$.
You stop at ___?___. $2\frac{3}{4} + \frac{3}{8} =$ ___?___.

Use the fraction scale to do Exs. 9–11.

9. $2\frac{3}{4} + 1\frac{1}{4}$ $\quad 2\frac{7}{8} + \frac{1}{4}$ $\quad 2\frac{3}{8} + \frac{7}{8}$

10. $1\frac{7}{8} + 1\frac{5}{8}$ $\quad 2\frac{3}{4} + \frac{7}{8}$ $\quad 2\frac{1}{2} + \frac{5}{8}$

11. $1\frac{7}{8} + 1\frac{1}{4}$ $\quad 1\frac{7}{8} + 1\frac{7}{8}$ $\quad 1\frac{3}{4} + 1\frac{1}{2}$

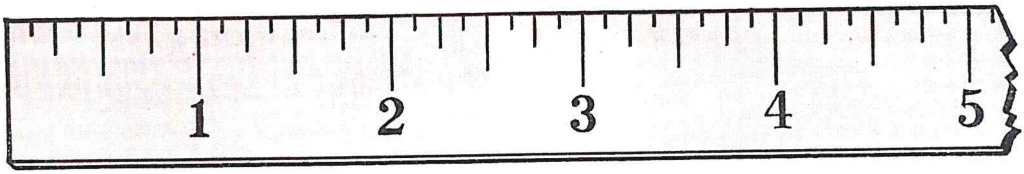
Try to do Exs. 12–14 by just imagining a fraction scale.

12. $6\frac{1}{4} + 5\frac{3}{4}$ $\quad 8\frac{7}{8} + 2\frac{1}{8}$ $\quad 5\frac{3}{4} + \frac{3}{8}$

13. $12\frac{1}{2} + 3\frac{3}{4}$ $\quad 4\frac{7}{8} + 4\frac{3}{8}$ $\quad 2\frac{3}{4} + 7\frac{5}{8}$

14. $8\frac{5}{8} + \frac{3}{4}$ $\quad 6\frac{7}{8} + 3\frac{1}{2}$ $\quad 1\frac{3}{4} + 2\frac{3}{8}$

Using a scale to subtract



1. To subtract $1\frac{1}{2}$ from 4, Mary imagines that she is at 4 on a scale. She counts back 1, to 3, and then back $\frac{1}{2}$ to $2\frac{1}{2}$. So $4 - 1\frac{1}{2} =$ _?_.

2. To check Mary's thinking, put your finger on 4 on the scale above; move it back 1, to _?_; then move it back $\frac{1}{2}$. You stop at _?_. So $4 - 1\frac{1}{2} =$ _?_.

3. Use the scale to subtract $\frac{1}{4}$ from $1\frac{1}{8}$.

Begin at $1\frac{1}{8}$; count back $\frac{1}{4}$, or $\frac{2}{8}$. You stop at _?_. So $\frac{1}{4}$ from $1\frac{1}{8}$ is _?_.

4. Use the scale to subtract $\frac{1}{2}$ from $2\frac{3}{8}$.

Begin at $2\frac{3}{8}$; count back $\frac{1}{2}$, or $\frac{4}{8}$, to _?_. So $\frac{1}{2}$ from $2\frac{3}{8} =$ _?_.

Use the scale to help you do these subtractions:

	a	b	c	d	e
5.	$3 - 1\frac{1}{4}$	$3 - 1\frac{3}{4}$	$3 - \frac{3}{4}$	$3 - 2\frac{1}{4}$	$3\frac{3}{4} - \frac{1}{8}$
6.	$3\frac{1}{4} - \frac{1}{2}$	$3\frac{1}{4} - \frac{3}{8}$	$3\frac{1}{4} - \frac{7}{8}$	$3\frac{1}{4} - 1\frac{3}{8}$	$3\frac{3}{4} - 1\frac{1}{8}$
7.	$3\frac{3}{8} - \frac{1}{2}$	$3\frac{3}{8} - \frac{5}{8}$	$3\frac{3}{8} - \frac{7}{8}$	$3\frac{3}{8} - \frac{3}{4}$	$3\frac{3}{4} - 1\frac{3}{8}$

Count backward on an imaginary scale to do these subtractions:

	a	b	c	d	e
8.	$5 - 1\frac{1}{8}$	$5 - 1\frac{3}{4}$	$5 - 2\frac{3}{8}$	$5 - 4\frac{5}{8}$	$7\frac{1}{8} - 3\frac{3}{4}$
9.	$4\frac{3}{8} - \frac{1}{2}$	$4\frac{3}{8} - \frac{5}{8}$	$4\frac{3}{8} - \frac{7}{8}$	$4\frac{3}{8} - 1\frac{1}{2}$	$8\frac{1}{4} - 5\frac{7}{8}$
10.	$6\frac{1}{8} - \frac{1}{4}$	$6\frac{1}{8} - \frac{3}{8}$	$6\frac{1}{8} - \frac{1}{2}$	$6\frac{1}{8} - 1\frac{5}{8}$	$8\frac{3}{8} - 6\frac{1}{2}$

11. Tom says that when he works with halves, fourths, and eighths, he has to use a scale of eighths.

What kind of scale would you use to work with halves and fourths? with halves, thirds, and sixths? with halves and tenths? with halves, fifths, and tenths?

Adding mixed numbers

1. Stanley wanted to find the sum of $1\frac{5}{8}$ and $1\frac{1}{2}$. This is the way he wrote the solution:

$$\begin{array}{r} 1\frac{5}{8} = 1\frac{5}{8} \\ 1\frac{1}{2} = 1\frac{4}{8} \\ \hline 2\frac{9}{8} = 3\frac{1}{8} \end{array}$$

Why did he change $1\frac{1}{2}$ to $1\frac{4}{8}$?

Stanley first added the fractions; then he added the whole numbers. $1\frac{5}{8} + 1\frac{4}{8} = 2\frac{9}{8}$. But $\frac{9}{8} = 1\frac{1}{8}$. So $2\frac{9}{8} = 2 + 1\frac{1}{8} =$ _?_.

Copy these examples without the answers. Add without looking in the book. Then check your work with the book.

2. $\begin{array}{r} 6\frac{3}{4} \\ 1\frac{1}{4} \\ \hline 7\frac{4}{4} = 8 \end{array}$

3. $\begin{array}{r} 5\frac{7}{8} \\ 3\frac{1}{8} \\ \hline 8\frac{8}{8} = 9 \end{array}$

4. $\begin{array}{r} 4\frac{3}{4} = 4\frac{6}{8} \\ 4\frac{3}{8} = 4\frac{3}{8} \\ \hline 8\frac{9}{8} = 9\frac{1}{8} \end{array}$

5. $\begin{array}{r} 13\frac{1}{3} = 13\frac{2}{6} \\ 5\frac{5}{6} = 5\frac{5}{6} \\ \hline 18\frac{7}{6} = 19\frac{1}{6} \end{array}$

6. Try to make a rule for adding mixed numbers. Then compare your rule with these three steps:

▶ Find the sum of the fractions.

▶ Find the sum of the whole numbers.

▶ If the sum of the fractions is an improper fraction, change it to a mixed number. Add this mixed number to the sum of the whole numbers in the example.

Copy and add. Check to see if each answer is sensible.

	a	b	c	d	e	f
7.	$2\frac{3}{4}$ $\frac{1}{8}$	$5\frac{3}{8}$ $2\frac{1}{8}$	$3\frac{5}{8}$ $2\frac{1}{2}$	$7\frac{3}{4}$ $2\frac{1}{4}$	$5\frac{5}{6}$ $3\frac{1}{3}$	$2\frac{3}{4}$ $4\frac{7}{8}$
8.	$3\frac{1}{2}$ $3\frac{3}{4}$	$5\frac{2}{3}$ $6\frac{1}{3}$	$2\frac{1}{4}$ $5\frac{7}{8}$	$5\frac{7}{8}$ $3\frac{1}{2}$	$4\frac{5}{12}$ $3\frac{1}{6}$	$3\frac{7}{12}$ $2\frac{1}{3}$
9.	$2\frac{3}{5}$ $4\frac{7}{10}$	$3\frac{1}{8}$ $4\frac{7}{8}$	$5\frac{3}{8}$ $4\frac{1}{2}$	$2\frac{9}{16}$ $3\frac{3}{4}$	$8\frac{1}{6}$ $9\frac{2}{3}$	$2\frac{3}{4}$ $\frac{1}{2}$
10.	$7\frac{2}{3}$ $8\frac{1}{3}$	$7\frac{5}{8}$ $3\frac{3}{4}$	$8\frac{1}{5}$ $9\frac{3}{5}$	$5\frac{3}{5}$ $\frac{7}{10}$	$\frac{1}{4}$ $2\frac{1}{2}$	9 $8\frac{7}{8}$

Adding and subtracting mixed numbers

1. Diana bought two ducks for dinner. One weighed $3\frac{1}{2}$ lb. The other weighed $2\frac{3}{4}$ lb. All together she bought __?__ lb. of duck.

2. Doris put her cat in a box, and found the cat and the box together weighed $4\frac{1}{2}$ lb. Then she weighed the box. It weighed $1\frac{1}{4}$ lb. So her cat weighed __?__ lb.

To find the answer to this problem, you must subtract $1\frac{1}{4}$ from $4\frac{1}{2}$. Subtract the fractions first and then the whole numbers.

$$\begin{array}{rcr} 4\frac{1}{2} & = & 4\frac{2}{4} \\ -\,1\frac{1}{4} & = & 1\frac{1}{4} \\ \hline & & 3\frac{1}{4} \end{array}$$

3. Ruth wants to make her father a carpenter's apron. The apron requires $1\frac{1}{8}$ yd. of ticking.

If Ruth cuts the ticking from a piece containing $2\frac{1}{4}$ yd., she will have __?__ yd. of ticking left.

4. Will Ruth (Ex. 3) have enough ticking left to make an apron for her brother Jerry if an apron to fit him requires $1\frac{3}{8}$ yd.?

Draw a diagram to prove your answer.

5. On a trip to camp, Eric rode for $2\frac{1}{4}$ hours on a train and $1\frac{3}{4}$ hours on a bus. In all, the trip to camp took __?__ hours.

Subtract:

	a	b	c	d	e	f
6.	$8\frac{5}{6}$ $4\frac{1}{2}$	$2\frac{3}{5}$ $1\frac{1}{10}$	$3\frac{3}{4}$ $1\frac{1}{2}$	$4\frac{5}{8}$ $3\frac{1}{8}$	$6\frac{5}{6}$ $2\frac{1}{3}$	$7\frac{7}{8}$ $3\frac{1}{4}$
7.	$3\frac{1}{2}$ $2\frac{1}{4}$	$4\frac{5}{6}$ $\frac{1}{6}$	$4\frac{5}{6}$ $2\frac{1}{3}$	$5\frac{1}{2}$ $3\frac{1}{8}$	$6\frac{2}{3}$ $2\frac{1}{3}$	$8\frac{3}{10}$ $2\frac{1}{5}$

Add:

	a	b	c	d	e	f
8.	$3\frac{5}{6}$ $2\frac{1}{3}$	$2\frac{3}{4}$ $1\frac{5}{8}$	$1\frac{3}{4}$ $2\frac{1}{8}$	$5\frac{3}{5}$ $4\frac{3}{5}$	$3\frac{7}{8}$ $2\frac{1}{2}$	$6\frac{3}{4}$ $7\frac{1}{4}$
9.	$4\frac{5}{12}$ $2\frac{2}{3}$	$3\frac{2}{3}$ $2\frac{1}{3}$	$3\frac{1}{2}$ $2\frac{3}{4}$	$5\frac{2}{3}$ $1\frac{2}{3}$	$2\frac{1}{4}$ $3\frac{7}{8}$	$5\frac{7}{10}$ $2\frac{3}{5}$

Problem study

If you have trouble with Problem 1 in Column A, do Problem 1 in Column B. Then go back and try Problem 1 in Column A again, and so on.

A

1. Bob can get a used bicycle for \$12.50. He will need to buy tires for it. The tires cost \$4.98 each. Find the total cost of the bicycle and the tires.

2. Sam left Atlanta, Georgia, at 8:00 P.M. and arrived in Newark, New Jersey, the following day at 5:00 P.M.

The distance from Atlanta to Newark is 861 miles, so Sam figured the train traveled at the rate of _?_ miles an hour.

3. Grace bought 3 boxes of Christmas cards at 60¢ a box. There were 20 cards in each box.

If Grace sold the cards for 5¢ apiece, how much did she gain on them?

4. Lois earns 40¢ an hour caring for Mrs. Pitt's baby. This week she has worked $8\frac{3}{4}$ hours. How much money has she earned?

5. The 32 girls of a cooking class baked 8 dozen Christmas cookies. They want to share the cookies equally. How many cookies should each girl receive?

B

1. Find the total cost of a gallon of ice cream at \$1.60 a gallon, and 2 lb. of cookies at 40¢ a pound.

2 × 40¢ = _?_ ¢

\$1.60 + \$.80 = _?_

2. How many hours is it from 8:00 P.M. today until 8:00 P.M. tomorrow? from 8:00 P.M. today until 5:00 P.M. tomorrow?

How can you find the rate at which you are traveling if you travel 50 miles in 2 hours? 150 miles in 3 hours?

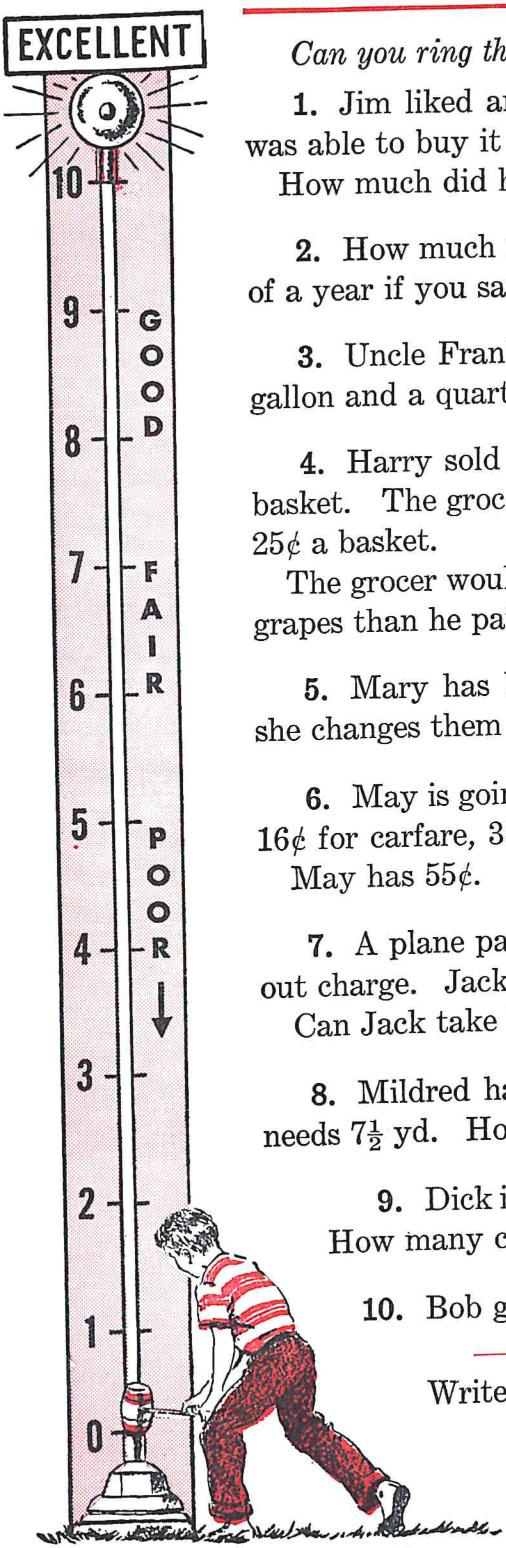
3. Six boxes of cards at 20¢ a box cost _?_. Six boxes of cards, with 20 cards in each box, contain _?_ cards. The selling price of 120 cards at 5¢ each is _?_. The gain is \$6.00 − \$1.20 = _?_.

4. At 40¢ an hour, how much can you earn in 2 hours? in $\frac{3}{4}$ of an hour? Then how much can you earn in $2\frac{3}{4}$ hours?

5. How do you find how many cookies there are in 8 dozen?

If 4 children wish to share 96 cookies, each child should take _?_ cookies.

Problem Test 3



Can you ring the bell in problem solving?

1. Jim liked an overcoat priced at \$27.95. His father was able to buy it for him at a winter sale for \$22.49. How much did his father save by waiting for the sale?

2. How much money would you have saved at the end of a year if you saved 75¢ every month?

3. Uncle Frank bought 8 gallons of gasoline at 21¢ a gallon and a quart of oil for 35¢. What was his bill?

4. Harry sold 20 baskets of grapes to a grocer at 18¢ a basket. The grocer told Harry he would sell the grapes for 25¢ a basket.
The grocer would receive \$$\underline{\ ?\ }$ more for the 20 baskets of grapes than he paid for them.

5. Mary has been saving nickels and now has 50. If she changes them to quarters, how many will she get?

6. May is going to the city on Saturday. She will need 16¢ for carfare, 35¢ for a movie ticket, and 40¢ for lunch. May has 55¢. She needs $\underline{\ ?\ }$¢ more.

7. A plane passenger is allowed 35 lb. of baggage without charge. Jack's bags weigh $16\frac{3}{4}$ lb. and $16\frac{1}{2}$ lb. Can Jack take both bags without charge?

8. Mildred has $4\frac{1}{4}$ yd. of ribbon to bind a quilt. She needs $7\frac{1}{2}$ yd. How many more yards should she buy?

9. Dick is sharing 5 cupcakes with two of his chums. How many cakes will each of the three boys receive?

10. Bob gathered 180 eggs or $\underline{\ ?\ }$ dozens of eggs.

Write your score on your Problem Test Record.

Self-Help Test 4

1. The number 5,089,029 is read _?_ million, _?_ thousand, _?_. **(6)**

2. Copy this number on your paper and place the commas correctly: 16275600. **(7)**

3. Write the Arabic numerals for LV, XXIV, XLVI. **(27–28)**

4. Write, using dollar sign and cents point:

8¢ 80 dollars 58¢ 229¢ **(111)**

5. Find $\frac{1}{5}$ of 4; divide 3 by 5; divide 2 by 3. **(48)**

6. Does $2436 \div 6 = 46$, or 406, or 460? **(62–63)**

7. Elsa's mother is dividing 4 large doughnuts equally among 5 girls.

Will each receive more than a whole doughnut, or almost a whole doughnut, or a very small part of a doughnut? **(48)**

8. What is $\frac{1}{6}$ of 17 in.? of 23 oz.? of 25 qt.? **(58)**

9. What is the remainder when 10 paper dolls are divided equally among 3 girls? **(56–58)**

10. Dora spent 50¢ for 3-cent stamps. How many stamps did she buy? How many pennies were left over? **(61)**

Self-Help Test 5

1. If 12 girls divide 75 jacks equally among them, how many jacks will each girl get? How many jacks will be left over? **(127)**

2. Find $\frac{2}{3}$ of 24 inches; $\frac{3}{4}$ of 12 months; $\frac{5}{6}$ of 30 gallons; $\frac{3}{5}$ of 50 cents. **(108–109)**

3. If an airplane travels 345 miles in 3 hours, it travels at the rate of _?_ miles an hour. **(85)**

4. Jerry is 10 years old. He says he has lived more than 3600 days. Prove that he is right. (365 da. = 1 yr.) **(85)**

Divide and check:

5. $21\overline{)86}$ **(80)** **6.** $42\overline{)217}$ **(81)** **7.** $32\overline{)681}$ **(88–92)**

8. $52\overline{)2368}$ **(96–97)** **9.** $48\overline{)3936}$ **(127–128)** **10.** $36\overline{)2284}$ **(131)**

Self-Help Test 6

1. What is $\frac{1}{4}$ of 40¢? What is $\frac{1}{8}$ of \$968? **(120)**

2. Change to mixed numbers: $\frac{16}{5}$ $\frac{21}{4}$ $\frac{23}{10}$ **(124–125)**

3. In the fraction $\frac{5}{8}$, is 5 the numerator? **(121)**

4. Is the fraction $\frac{3}{5}$ an improper fraction? **(123)**

5. Reduce to lowest terms: $\frac{9}{12}$ $\frac{6}{16}$ $\frac{8}{16}$ **(148)**

6. Find the cost of $2\frac{3}{4}$ pounds of fish at 36 cents a pound. **(110)**

7. Add: $\frac{5}{6}$ and $\frac{6}{6}$ $\frac{7}{10}$ and $\frac{3}{10}$ $\frac{5}{12}$ and $\frac{5}{12}$ **(136–137)**

8. Subtract: $\frac{5}{12}$ from $\frac{7}{12}$ $\frac{3}{10}$ from $\frac{9}{10}$ $\frac{1}{8}$ from $\frac{7}{8}$ **(136–137)**

9. Find: $\frac{3}{8}+\frac{1}{2}$ $\frac{5}{6}+\frac{1}{3}$ $\frac{5}{12}+\frac{1}{6}$ **(145)**

10. Find: $\frac{4}{5}-\frac{3}{10}$ $\frac{5}{6}-\frac{1}{2}$ $\frac{7}{16}-\frac{1}{4}$ **(146 and 148)**

11. $\frac{1}{4}=\frac{?}{8}$ $\frac{1}{3}=\frac{?}{6}$ $\frac{3}{4}=\frac{?}{12}$ **(144)**

12. Add $3\frac{1}{2}$ and $2\frac{3}{8}$. **(151)**

13. From $6\frac{7}{12}$ take $2\frac{1}{4}$. **(152)**

14. Last year $2\frac{5}{8}$ in. of snow fell on Thanksgiving Day. This year $1\frac{1}{4}$ in. fell.

How many more inches fell last year than this year on Thanksgiving Day? **(152)**

15. Ed earned 40¢ carrying groceries. He says he always saves $\frac{1}{4}$ of his earnings. How much of the 40¢ will he save? **(120)**

16. Which fraction in each of these pairs is larger?

$\frac{5}{6}$ or $\frac{2}{3}$ $\frac{5}{8}$ or $\frac{1}{2}$ $\frac{9}{16}$ or $\frac{3}{4}$ **(146)**

Choose the sensible answer to each example. Then work the example to see if you are right.

17. Does $52\overline{)1196}$ equal 32, or 23, or 13? **(96–97)**

18. Does $4\frac{4}{6}+5\frac{1}{2}$ equal $6\frac{1}{6}$, or $12\frac{5}{6}$, or $10\frac{1}{6}$? **(151)**

19. Does $4956 \div 7 = 708$, or 78, or 780? **(62–63)**

20. Does $\frac{7}{8}-\frac{1}{4}=\frac{3}{8}$, $1\frac{5}{8}$, or $\frac{5}{8}$? **(146)**

21. Does $10\frac{1}{2}-3\frac{1}{4}=5\frac{1}{2}$, or $7\frac{1}{4}$, or $7\frac{1}{2}$? **(152)**

22. Does $3\frac{2}{3}\times 60 = 160$, or 330, or 220? **(110)**

Measuring your growth in arithmetic

Work carefully. Check your answers. Be sure your answers are sensible.

1. Ralph needs $1\frac{1}{4}$ yards of cloth to make a sail.

If he cuts the $1\frac{1}{4}$ yards from a piece $2\frac{1}{2}$ yards long, will there be enough cloth left for him to give Bill, so that Bill can make a sail the same size?

2. Peggy needs $\frac{1}{2}$ yard of rayon for a collar and $\frac{1}{8}$ yard for each of 2 ruffles. How much rayon should she buy?

3. Max has 11 quarters. If he has them changed into dollar bills, how many dollar bills will he get? How many quarters will he have left over? $\frac{11}{4} = \underline{\ ?\ }$.

4. Among the four numbers below find:

- a proper fraction
- a mixed number
- two improper fractions
- the numerator of the proper fraction

$\frac{11}{6}$ $5\frac{5}{6}$ $\frac{9}{8}$ $\frac{2}{3}$

5. How many more oranges would you get if you bought $\frac{1}{2}$ doz. than if you bought $\frac{1}{3}$ doz.?

6. $\begin{array}{r} \frac{9}{10} \\ -\frac{4}{10} \\ \hline \end{array}$

7. $\begin{array}{r} 3\frac{1}{2} \\ -\frac{5}{12} \\ \hline \end{array}$

8. $\frac{3}{5} = \frac{?}{10}$

9. $42\overline{)1954}$

10. Divide 441 by 58.

Just for fun

- Paul said, "I can prove that Chicago is $\frac{3}{8}$ of a chipmunk, $\frac{2}{7}$ of a catfish, and $\frac{1}{3}$ of a gopher."

- Stewart said, "That's nothing. I can prove that Australia is $\frac{2}{7}$ authors, $\frac{4}{9}$ strangers, and $\frac{3}{5}$ liars."

Can you figure out what Paul and Stewart meant?

- Violet is what fractional part of violin? what fractional part of eternal?

Tell whether these statements are true. Illustrate.

1. The smallest 3-place number is larger than the largest 2-place number.

2. The number of feet in a length of rope is 3 times the number of yards in its length.

3. One half of an even number is an even number.

UNIT 20

Using common measures. Finding perimeters. Reading a scale drawing. Dry measure. Finding what part one number is of another

A trip to the Statue of Liberty

1. Miss Cole, her 31 pupils, and 3 of their mothers went by boat from a New York pier to the Statue of Liberty. The tickets were $.35 each for pupils and $.70 for grownups. How much did all the tickets cost?

2. Miss Cole gave the ticket agent $15.00. How much change should she have received?

3. At the Statue an elevator takes people from the ground floor to the top of the pedestal for $.05 each. How much will it cost 35 people to ride?

Giving the agent $2.00, Miss Cole paid 35 fares. How much change should she have received?

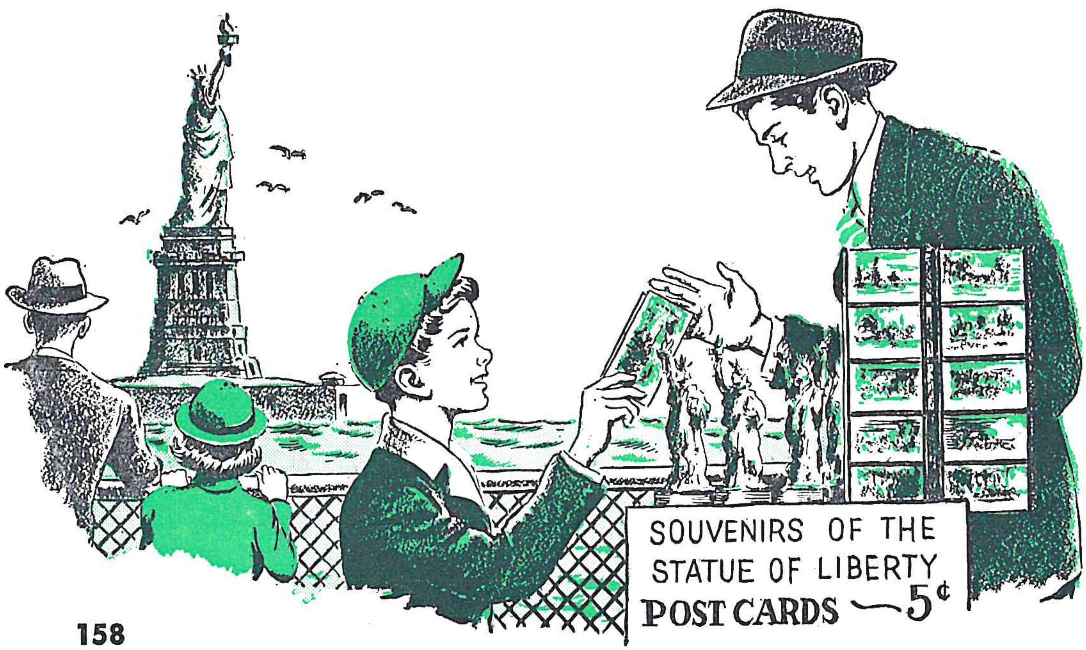
4. "There are 168 steps from the foot of the Statue to the head," said Miss Cole.

"Whew!" exclaimed Jimmy, "there are only 14 steps in our stairs at home. The Statue has __?__ times as many!"

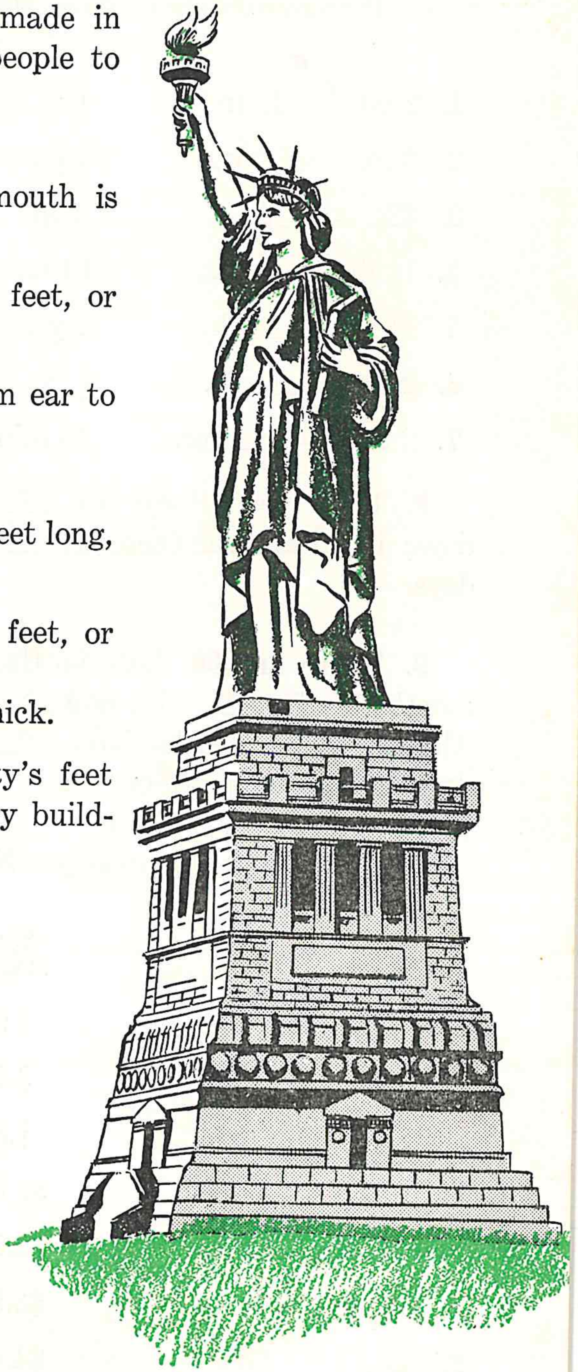
5. "Only 40 persons can stand in the Statue's head at one time," said the guide. "Fifteen are there now.

"If all 35 of you want to go together, you will have to wait until __?__ people leave."

6. Look at the picture. Then tell how much Peter will have to pay for the 8 post cards he is buying.



Measures of weight and length



1. The Statue of Liberty was made in France and given by the French people to the United States in 1884.

How many years ago was that?

2. The width of the Statue's mouth is 3 feet, or _?_ yard, or _?_ inches.

3. The length of the nose is $4\frac{1}{2}$ feet, or 4 feet _?_ inches.

4. The head is 10 feet thick from ear to ear. 10 feet is _?_ yards _?_ foot.

Show a distance of 10 feet.

5. The Statue's index finger is 8 feet long, or _?_ yards _?_ feet.

6. The Statue's right arm is 42 feet, or _?_ yards, long.

The arm is 12 feet, or _?_ yards, thick.

7. The height from Miss Liberty's feet to her torch is 151 feet. One 10-story building is 110 feet high.

How much higher is Miss Liberty?

8. From the base to the torch the Statue measures $305\frac{1}{2}$ feet.

How much higher is this than a 25-story building that is 300 feet high?

9. The copper covering on the Statue weighs 100 tons. How many pounds are there in 1 ton? in 10 tons? in 100 tons?

10. The whole Statue weighs 225 tons, or _?_ pounds.

Important measures

If you need help on these, study the tables on page 309.

	a	b	c
1.	2 yd. = ? in.	4 qt. = ? pt.	5 dollars = ? ¢
2.	3 lb. = ? oz.	$\frac{1}{2}$ yr. = ? mo.	$1\frac{1}{2}$ yd. = ? in.
3.	$\$2\frac{1}{4}$ = ? ¢	3 wk. = ? da.	$1\frac{3}{4}$ hr. = ? min.
4.	$1\frac{1}{4}$ lb. = ? oz.	14 da. = ? wk.	24 qt. = ? gal.
5.	$1\frac{1}{2}$ T. = ? lb.	2 yr. = ? mo.	1 mi. = ? ft.
6.	2 da. = ? hr.	$\frac{1}{2}$ hr. = ? min.	2 yd. 1 ft. = ? ft.
7.	2 min. = ? sec.	15 min. = ? hr.	1 yd. 8 in. = ? in.

8. In a year there are ? days; in a leap year there are ? days.

9. There are 30 days in the months of ?, ?, ?, and ?. All the other months have ? days except the month of ?.

10. February has ? days, except in leap year, when it has ? days.

Leap year comes every ? years. (Any leap year can be divided evenly by 4.)

The last leap year was ?. The next leap year will be ?.

Tell how much change you should get if:

	A YOU SPEND	A YOU GIVE	B YOU SPEND	B YOU GIVE	C YOU SPEND	C YOU GIVE
11.	8¢	10¢	\$.60	\$.75	\$.62	\$1.00
12.	15¢	25¢	\$.78	\$1.00	\$.45	\$1.00
13.	35¢	50¢	\$.83	\$1.00	\$.59	\$1.00
14.	\$1.50	\$2.00	\$1.69	\$2.00	\$6.75	\$10.00
15.	\$1.79	\$2.00	\$2.21	\$3.00	\$7.29	\$10.00
16.	\$2.25	\$5.00	\$3.98	\$5.00	\$8.98	\$10.00
17.	\$3.75	\$5.00	\$4.49	\$5.00	\$9.89	\$10.00

Perimeters

The girls in Miss Fry's class are making a large map of their town. When it is finished, they will frame it and hang it in the room.

Ruth stopped at a shop and said, "I should like some framing for a map."

"How large is the map?" the clerk asked.

"I don't know exactly," she replied.

"The framing will cost you $.24 a foot," he said. "Find out how many feet you need."

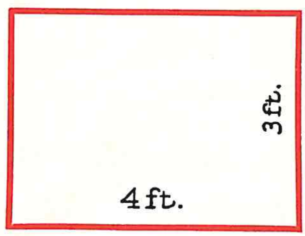
Ruth went back to Miss Fry and learned that the map was shaped like a *rectangle*.

A ***rectangle*** is a figure with 4 sides and 4 square corners. The *length* and the *width* of a rectangle are called its ***dimensions***.

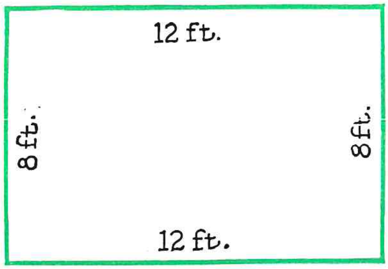
To find how many feet of framing were needed, the girls had to find the *perimeter* of the map. The distance around a figure is called its ***perimeter***.

Ruth measured and found that the frame would have to be 4 feet long and 3 feet wide. (Draw the frame on the blackboard.) Ruth said:

"Then we'll need 4 ft. + 3 ft. + 4 ft. + 3 ft., or 14 ft. of framing. 14 ft. of framing at $.24 a foot will cost __?__."



Perimeters



1. To find the perimeter of this rectangle:

① Joan thought:
"12 ft. + 8 ft. + 12 ft. + 8 ft. = 40 ft."

② George thought:
"12 ft. + 8 ft. = 20 ft.
"2 × 20 ft. = 40 ft."

③ Mary thought:
"2 × 12 ft. = 24 ft.
"2 × 8 ft. = 16 ft.
"24 ft. + 16 ft. = 40 ft."

Make a rule for finding perimeters by Joan's method; George's method; Mary's method. Whose method do you like best?

2. Find the perimeter of a rectangle 2 ft. long and 1 ft. wide; of one 3 ft. long and 2 ft. wide.

3. What is the perimeter of a rectangle 18 ft. by 12 ft.?

"18 ft. by 12 ft." is a short way of saying "18 ft. long and 12 ft. wide."

The dimensions may also be written this way: $18' \times 12'$. $18'$ means 18 feet; $12'$ means 12 feet. The × is read *by*.

4. A rectangle $8' \times 6'$ is 8 __?__ long and 6 __?__ wide. What is the perimeter of this rectangle?

5. What is the perimeter of a rectangle $10' \times 8'$?

Find these perimeters:

6. $4'$ by $2'$ **7.** $6\frac{1}{2}'$ by $4\frac{1}{4}'$

8. $5\frac{1}{4}'$ by $3'$ **9.** $10'$ by $4\frac{1}{3}'$

10. Find the perimeter of a map 8 inches by 8 inches.

Such a map is in the shape of a ***square***. A square is a rectangle whose dimensions are equal.

8 inches by 8 inches may be written $8'' \times 8''$.

11. Bob has a map 1 ft. long and 8 in. wide. He figures that he will need 1 + 8 + 1 + 8, or 18 ft. of framing.

What is wrong with his work? How many inches will he need? How many feet?

When you find the perimeter of a rectangle, the length and the width must be in the same units.

Estimating answers

Bob should have estimated his answer in Ex. 11, page 162. He would have seen quickly that he did not need 18 feet to frame a picture only 1 foot long and less than 1 foot wide.

Do you estimate your answers so that you will not make foolish mistakes?

1. To estimate the perimeter of a map 1 ft. long and 8 in. wide, think, "I'll need 2 feet for the 2 lengths and less than 2 feet for the 2 widths.

"All together I'll need less than _?_ feet."

2. Howard wants a book that costs 22¢ and a knife that costs 65¢. Can he buy them with a dollar?

Think, "There are 2 tens in 22 and 6 tens in 65. 2 tens and 6 tens are _?_ tens. 8 tens are _?_.

"Howard can buy the book and the knife for less than a dollar."

3. To estimate the cost of 14 ft. of framing at $.24 a foot, think, "$.24 is about a quarter. At a quarter a foot I can get 4 ft. for $1.00, or 12 ft. for $3.00.

"The extra 2 ft. will cost $.50; so 14 ft. will cost about _?_."

4. There are 9 shelves in the cooking room. Each shelf is about 4 feet long. Shelf paper comes in 20-foot rolls.

Estimate how many rolls you would order to cover these shelves.

5. The pupils in the sewing class have saved $10.00 to buy curtain material for the sewing room. They need 24 yards.

Estimate whether they can pay as much as 10 cents a yard; 20 cents a yard; 30 cents a yard; 40 cents a yard; 50 cents a yard.

6. Estimate how much Rolland must save each week for a year, in order to have enough to buy a 25-dollar chemistry set.

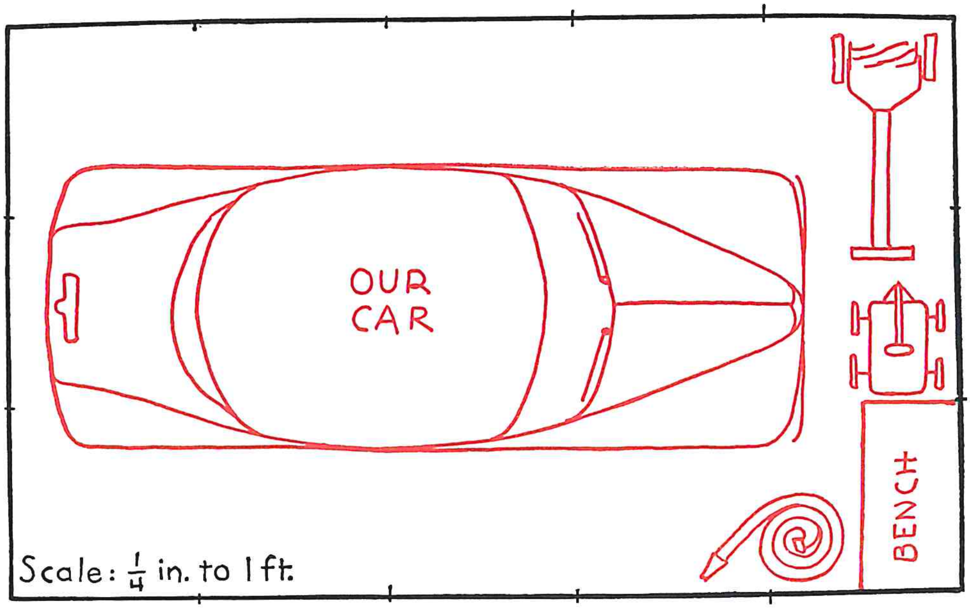
7. Jane eats an egg for breakfast every morning. How many eggs does she eat at breakfast in a year?

Would you estimate that Jane eats about 20 doz., 30 doz., or 40 doz. eggs at breakfast during the year?

8. What facts do you need to know to estimate the cost of enough arithmetic books to supply your class?

9. Estimate some heights and lengths in feet; in inches.

Reading a floor plan



Albert is helping his father build a garage. The dimensions of the garage are to be 12 feet wide by 20 feet long.

1. Albert made the drawing above to show the floor plan.

The drawing is _?_ inches wide and _?_ inches long.

2. One inch on the drawing stands for _?_ feet.

3. Albert said he was using the ***scale*** of $\frac{1}{4}$ inch to 1 foot. His drawing is _?_ fourths inch wide and _?_ fourths inch long.

4. A scale of "$\frac{1}{4}$ inch to 1 foot" is the same as "1 inch to _?_ feet."

5. Albert knew that the garage door should be eight feet wide. On his drawing the door should be _?_ in. wide.

6. Each garage window was to be 4 feet wide. On the drawing a window should be _?_ in. wide.

7. How long would Albert's drawing be if it were made to the scale of 1 inch to 1 foot? How wide?

8. How long would Albert's drawing be if it were made to the scale of $\frac{1}{2}$ inch to a foot? How wide would the drawing be?

Would this page be large enough for that drawing?

Arithmetic roundup

Oral review

1. The numerator is smaller than the denominator in a __?__ fraction.

2. The numerator is the same as or larger than the denominator in an __?__ fraction.

3. Change to twelfths:

$\frac{1}{2}$ $\quad$ $\frac{2}{3}$ $\quad$ $\frac{3}{4}$ $\quad$ $\frac{1}{6}$ $\quad$ $\frac{5}{6}$

4. Change to mixed numbers:

$\frac{17}{5}$ $\quad$ $\frac{13}{4}$ $\quad$ $\frac{13}{2}$ $\quad$ $\frac{25}{8}$ $\quad$ $\frac{26}{4}$

5. At 20¢ a pound, $\frac{3}{4}$ lb. of raisins will cost __?__¢.

6. Find the cost of $\frac{5}{8}$ lb. of suet at 8¢ a pound and 10 cents worth of bird seed.

7. If $\frac{1}{2}$ doz. ink erasers cost 30¢, one eraser will cost __?__¢.

8. How can you tell whether the 7 in this division is correct?

$$\boxed{\begin{array}{r} 7 \\ 36\overline{)226} \end{array}}$$

9. You owe 31¢ and give the clerk a half dollar.
Your change should be __?__¢.

10. Is $1695 \div 41$ about 4, or 40, or 20?

11. At the rate of two caramels for 1¢, 6 caramels will cost __?__¢.

12. If the scale is 1 in. to 4 mi., this line ———— represents a distance of __?__ mi.

Written review

Watch the signs!

1. $\begin{array}{r} \frac{1}{8} \\ +\frac{4}{8} \\ \hline \end{array}$ 2. $\begin{array}{r} \frac{1}{4} \\ +\frac{3}{8} \\ \hline \end{array}$ 3. $\begin{array}{r} \frac{2}{3} \\ +\frac{1}{6} \\ \hline \end{array}$ 4. $\begin{array}{r} 1\frac{11}{12} \\ +3\frac{1}{6} \\ \hline \end{array}$ 5. $\begin{array}{r} \frac{7}{8} \\ -\frac{3}{8} \\ \hline \end{array}$ 6. $\begin{array}{r} \frac{7}{10} \\ -\frac{1}{2} \\ \hline \end{array}$ 7. $\begin{array}{r} 4\frac{1}{2} \\ -4\frac{1}{4} \\ \hline \end{array}$

8. $\begin{array}{r} 1000 \\ +780 \\ \hline \end{array}$ 9. $\begin{array}{r} \$12.50 \\ +5.00 \\ \hline \end{array}$ 10. $\begin{array}{r} 506 \\ \times 78 \\ \hline \end{array}$ 11. $\begin{array}{r} 787 \\ \times 90 \\ \hline \end{array}$ 12. $\begin{array}{r} 2000 \\ -608 \\ \hline \end{array}$

13. $\begin{array}{r} 1000 \\ +695 \\ \hline \end{array}$ 14. $\begin{array}{r} \$12.00 \\ +5.50 \\ \hline \end{array}$ 15. $\begin{array}{r} 407 \\ \times 56 \\ \hline \end{array}$ 16. $\begin{array}{r} 879 \\ \times 60 \\ \hline \end{array}$ 17. $\begin{array}{r} 640 \\ \times 5 \\ \hline \end{array}$

Quarts, pecks, and bushels

In some places fruits, vegetables, and grains are sold by weight — that is, by pounds and ounces. In other places they are sold by ***dry measure***. Sometimes they are sold both ways.

Common units of dry measure are ***pints, quarts, pecks,*** and ***bushels***.

How are fruits, vegetables, and grains measured where you live?

The class should have a pint, a quart, a peck, and a bushel measure to prove that:

1. It takes 2 pints to fill a quart measure.

2. One peck measure holds 8 quarts.

3. 4 qt. = $\frac{1}{2}$ pk.

4. One bushel measure holds 4 pecks, or 32 quarts.

5. Learn these measures:

2 pints (pt.) =	**1 quart (qt.)**
8 quarts =	**1 peck (pk.)**
4 pecks =	**1 bushel (bu.)**

6. Name five things you could measure by the dry quart. Name five things you could measure by the liquid quart.

7. Janice's pony eats 2 quarts of oats a day. How many days will it take the pony to eat a bushel of oats?

8. Tim has only a peck measure. How can he measure a bushel of something?

9. Ed bought $\frac{1}{2}$ bushel of potatoes. How many pecks is that?

10. Bill and Tom have to carry ashes out of their cellar. They have a bushel basket and a peck basket.

If they use the peck basket, they will have to make _?_ times as many trips as they will if they use the bushel basket.

11. Jack works at his father's roadside stand. A lady asked for a peck of string beans. John had only a quart measure. How could he measure out a peck of beans?

12. John can carry a bushel of pine cones. He can't carry a bushel of potatoes. How do you explain this?

13. See if you can find at the library the weight of a bushel of potatoes; a bushel of apples; a bushel of oats.

Problems and practice

1. At \$3 a bushel, 2 pecks of apples will cost __?__.

2. Alice is making 4 place mats for the table in the breakfast nook. Each mat is 15 in. long and 10 in. wide.

She has 5 yd. of binding to sew around the edges of the mats. Has she enough?

3. The oldest city in the United States is St. Augustine, Florida. It was founded in 1565. How old is it?

4. The boys in Tom's class marked off a running track 75 yd. long on the school grounds. It was __?__ ft. long.

5. Tom is paid 25¢ an hour for his Saturday work. How much will he earn if he works 6 hr. next Saturday?

6. How much will $\frac{1}{2}$ doz. glasses of jelly at 18¢ a glass and $1\frac{1}{2}$ lb. of stuffed dates at 60¢ a pound cost?

7. Arnold has bought a pair of dark glasses for 45¢, a ski cap for \$1.29, and a muffler for 79¢.

How much change should he receive if he gives the clerk two 2-dollar bills?

8. At 72 cents a dozen, would the cost of 8 grapefruit be closer to 50 cents or to 60 cents?

9. Find the sum of:
$86 + 368 + 98 + 785$.

10. Find the sum of:
\$4.95 + \$3.89 + \$15.87 + \$56.58.

11. From 7201 take 3196.

12. From \$208.70 take \$64.98.

13. Multiply 2610 by 55.

14. Divide 1378 by 65.

15. Divide 2610 by 55.

16. Add $3\frac{7}{12}$ and $1\frac{1}{3}$.

17. From $3\frac{7}{8}$ take $1\frac{1}{4}$.

18. Write in figures:
One hundred thousand, five

19. Write in figures:
Two million, five thousand, one hundred thirty-two

20. The number that is 1200 larger than 870 is __?__.

21. Does $2074 \div 34$ equal about 6, about 60, or about 600?

22. If $54 \times 72 = 3888$, then $3888 \div 72 =$ __?__.

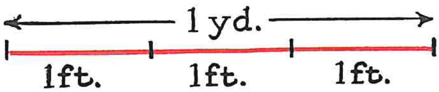
23. Which is more: 5×76, or 372?

A part of a whole

Ruth wanted to buy a blue hair ribbon for her baby sister. She measured the baby's pink hair ribbon with a foot ruler. The ribbon was 1 foot long.

Ruth went to the store. She said to the clerk, "I'd like a foot of this blue ribbon."

Ruth thought, "That ribbon costs 15¢ a yard. I wonder how much a foot will cost?" Do you know? What part of a yard is a foot?



Remember that the denominator of a fraction tells into how many equal parts an object is divided.

The numerator tells how many of those parts you are talking about.

A yard is divided into __?__ feet. If you are talking about 1 foot, you are talking about $\frac{1}{3}$ of a yard.

One third of a yard of ribbon will cost $\frac{1}{3}$ of 15¢, or __?__ cents.

1. What part of a yard is 2 feet?

2. At 15¢ a yard, how much will 2 feet of ribbon cost?

3. At 30¢ a yard, how much will 1 foot of wire cost? 2 feet?

4. An hour is divided into 60 minutes. If I think of 1 minute, I am thinking of $\frac{1}{60}$ of an hour. If I think of 2 minutes, I am thinking of $\frac{?}{60}$ of an hour.

Can $\frac{2}{60}$ be reduced to $\frac{1}{30}$? How?

5. Ten minutes is what part of an hour? Reduce $\frac{10}{60}$ to lowest terms. (Here you are comparing 10 minutes with 60 minutes.)

6. 15 minutes is what part of an hour? Reduce $\frac{15}{60}$ to lowest terms. (Here you are comparing __?__ minutes with __?__ minutes.)

7. 20 minutes is what part of an hour? Reduce $\frac{20}{60}$ to lowest terms. (Here you are comparing __?__ minutes with __?__ minutes.)

8. What part of an hour is 30 min.? 40 min.? 45 min.? 50 min.?

9. Harry is paid 30¢ an hour for cutting a lawn.

How much does he earn when he works 10 min.? 15 min.? 20 min.? 30 min.? 40 min.? 45 min.? 50 min.? 60 min.?

10. Larry earns 50¢ an hour. How much does he earn when he works 30 min.?

11. Harry wanted $\frac{1}{2}$ pound of beef. The piece the butcher put on the scales weighed 10 ounces. Was that more than $\frac{1}{2}$ pound?

Try to find the cost of 10 ounces of beef at 80¢ a pound without reading further.

A pound is divided into 16 equal parts. Each part is an ounce. If you think of 1 ounce, you are thinking of $\frac{1}{16}$ of a pound.

If you think of 10 ounces, what part of a pound are you thinking of? $\frac{10}{16} = \frac{?}{?}$.

At 80¢ a pound, what will $\frac{5}{8}$ pound of beef cost?

12. At 80 cents a pound, what will 4 ounces of beef cost? 6 ounces? 8 ounces? 12? 14? 16?

13. How many cents are there in a dollar? A cent is what part of a dollar?

14. What part of a dollar is 5¢? 10¢? 20¢? 25¢? 40¢? 50¢? 60¢? 75¢? 80¢?

15. How many things are there in a dozen? What part of a dozen is 1 thing?

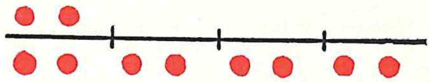
16. What part of a dozen are 2 things? 3 things? 4 things? 5? 6? 7? 8? 9? 10? 11? 12?

17. What part of a foot is 1 in.? 2 in.? 3 in.? 4 in.?

18. How many inches are there in a yard? What part of a yard is 1 inch? 12 inches? 18 inches? 24 inches? 27 inches?

19. At 60¢ a yard, find the cost of 12 in. of material; of 18 in.; 24 in.; 27 in.; 30 in.

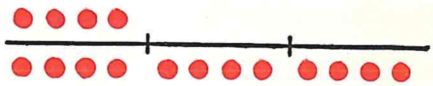
20. Joe made this diagram to compare 2 and 8:



Does the diagram show that:

- 2 is $\frac{1}{4}$ of 8?
- $8 \div 2 = 4$?
- $\frac{1}{4}$ of $8 = 2$?
- $\frac{2}{8} = \frac{1}{4}$?
- $2 \div 8 = \frac{1}{4}$?
- $4 \times 2 = 8$?

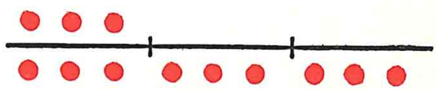
21. Joe made this diagram to compare 4 and 12:



Does the diagram show that:

- 4 is $\frac{1}{3}$ of 12?
- $12 \div 4 = 3$?
- $12 = 3 \times 4$?
- $\frac{4}{12} = \frac{1}{3}$?
- $4 \div 12 = \frac{1}{3}$?
- $\frac{1}{3}$ of $12 = 4$?

22. Tell 6 things you can learn from this diagram:



23. At 75 cents a dozen, the cost of 4 grapefruit is _?_ cents.

Oral practice in changing measures

Tell which of these statements are **true** *and which are* **false**:

1. To change feet to inches, multiply by 12.

2. To change feet to yards, multiply by 3.

3. To change minutes to hours, divide by 60.

4. To change miles to feet, multiply by 5280.

5. To change yards to inches, multiply by 36.

6. To change pounds to ounces, divide by 16.

7. To change tons to pounds, multiply by 2000.

8. To change gallons to quarts, divide by 4.

9. To change large units to smaller units, multiply.

10. To change small units to larger units, divide.

Tell the missing numbers.

	a	b	c
11.	$2\frac{1}{2}$ ft. = ? in.	$1\frac{1}{4}$ yd. = ? in.	75 min. = 1 hr. ? min.
12.	6 lb. = ? oz.	$6\frac{1}{2}$ ft. = ? in.	1 hr. 30 min. = ? min.
13.	60 in. = ? ft.	$2\frac{1}{3}$ lb. = ? oz.	10 qt. = ? gal. ? qt.

14. Explain how the division in the box shows that a water pipe 64 inches long is $5\frac{1}{3}$ feet long.

$$\begin{array}{r} 5\frac{4}{12} = 5\frac{1}{3} \\ 12\overline{)64} \\ \underline{60} \\ 4 \end{array}$$

Which statements are **true** *and which are* **false**?

	a	b	c
15.	18 in. = $1\frac{1}{2}$ ft.	6 qt. = $1\frac{1}{4}$ gal.	28 = $2\frac{1}{4}$ doz.
16.	28 in. = $2\frac{1}{3}$ ft.	20 oz. = $1\frac{1}{4}$ lb.	31 da. = $4\frac{3}{7}$ wk.
17.	42 in. = $1\frac{1}{6}$ yd.	24 oz. = $1\frac{1}{2}$ lb.	17 pt. = $8\frac{1}{2}$ qt.
18.	48 in. = $1\frac{1}{3}$ yd.	36 oz. = $2\frac{1}{2}$ lb.	20 ft. = $6\frac{2}{3}$ yd.

Finding costs

Each Tuesday Mr. Carter sells his baked goods on Park St. Use the picture to help answer these questions:

1. Andrew bought 4 tea cakes from Mr. Carter. Andrew thought, "Four cakes is one __?__ of a dozen. A dozen cakes cost __?__¢. "So $\frac{1}{3}$ dozen will cost __?__¢."

2. Find the cost of 8 cinnamon buns (8 buns is what part of a dozen?); 6 buns; 4 buns.

3. Find the cost of 6 cookies; 9 cookies; 3 cookies.

4. Find the cost of 4 oz. of walnut wafers; 8 oz.; 12 oz.

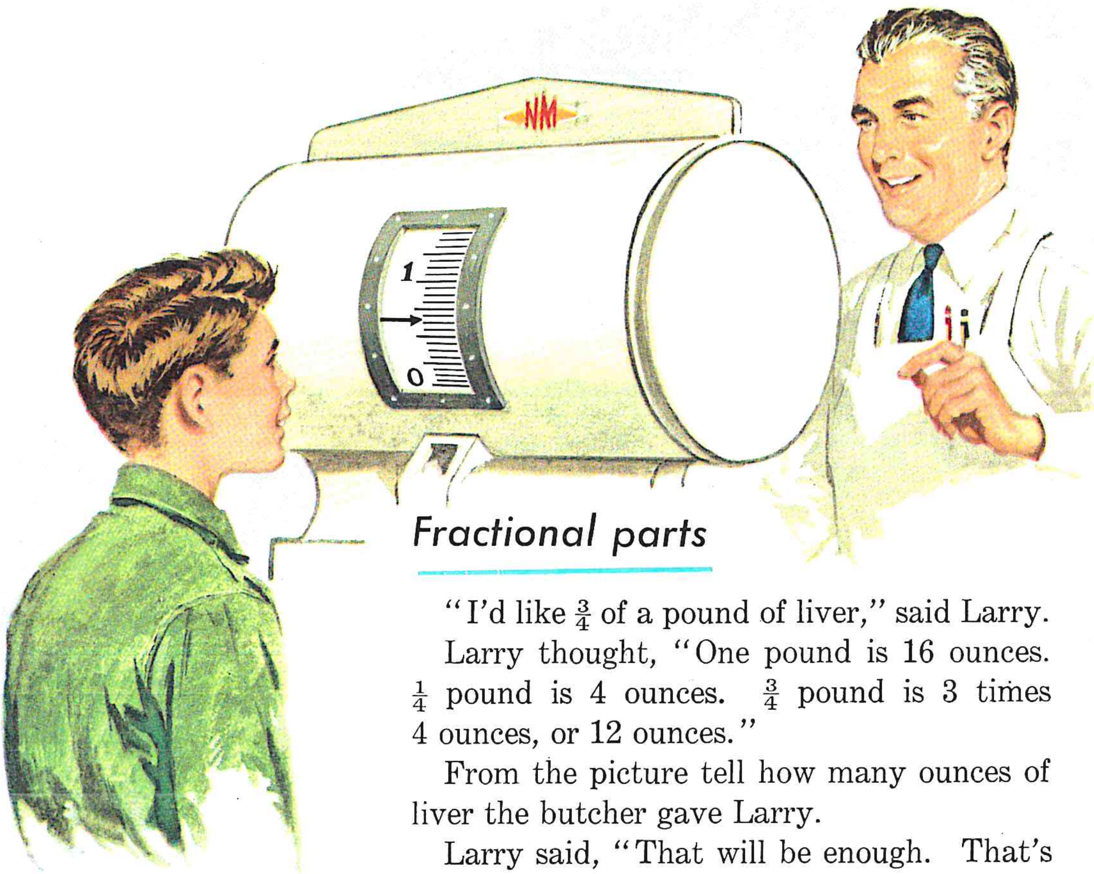
5. Find the cost of 2 jelly doughnuts; 3; 4; 6; 8; 9; 10.

6. Find the cost of 18 cinnamon buns; 30; 40.

7. Find the cost of 16 cookies; 20; 24; 30.

8. Find the cost of 18 jelly doughnuts; 24; 32.

9. Mary bought 1 lb. 8 oz. of walnut wafers.
How much change did Mary receive from a 5-dollar bill?



Fractional parts

"I'd like $\frac{3}{4}$ of a pound of liver," said Larry.

Larry thought, "One pound is 16 ounces. $\frac{1}{4}$ pound is 4 ounces. $\frac{3}{4}$ pound is 3 times 4 ounces, or 12 ounces."

From the picture tell how many ounces of liver the butcher gave Larry.

Larry said, "That will be enough. That's only ___?___ oz. less than I wanted."

Tell the missing numbers in these examples:

	a	*b*	*c*
1.	$\frac{1}{2}$ lb. = ___?___ oz.	$\frac{1}{2}$ pt. = ___?___ cup	$\frac{1}{2}$ T. = ___?___ lb.
2.	$\frac{1}{3}$ yd. = ___?___ ft.	$\frac{1}{3}$ ft. = ___?___ in.	$\frac{1}{4}$ gal. = ___?___ qt.
3.	$\frac{1}{4}$ ft. = ___?___ in. $\frac{3}{4}$ ft. = ___?___ in.	$\frac{1}{4}$ bu. = ___?___ pk. $\frac{3}{4}$ bu. = ___?___ pk.	$\frac{1}{4}$ yr. = ___?___ mo. $\frac{3}{4}$ yr. = ___?___ mo.
4.	$\frac{1}{8}$ pk. = ___?___ qt. $\frac{3}{8}$ pk. = ___?___ qt.	$\frac{1}{16}$ lb. = ___?___ oz. $\frac{3}{16}$ lb. = ___?___ oz.	$\frac{1}{4}$ doz. = ___?___ $\frac{3}{4}$ doz. = ___?___
5.	$\frac{1}{4}$ hr. = ___?___ min. $\frac{3}{4}$ hr. = ___?___ min.	$\frac{1}{3}$ doz. = ___?___ $\frac{2}{3}$ doz. = ___?___	$\frac{1}{4}$ T. = ___?___ lb. $\frac{3}{4}$ T. = ___?___ lb.

Three-figure quotients

1. James and his family are going to drive from their home in California to Hartford, Connecticut, a distance of about 3100 miles.

They can travel about 20 miles on a gallon of gasoline.

Without help, can you find out about how many gallons of gasoline they will use on their trip?

2. To find the answer to Ex. 1, you need to do this division: $20\overline{)3100}$. Which of these estimates of the quotient is correct?

- Less than 10 gallons.
- Between 10 and 100 gallons.
- Between 100 and 1000 gallons.

3. If the answer to the division is less than 10 gallons, the answer will be a _?_-figure number.

4. If the answer to the division is between 10 and 100, the answer will be a _?_-figure number.

5. If the answer to the division is more than 100 but less than 1000, the answer will be a _?_-figure number.

6. In Ex. 2 above, you decided that the answer to $20\overline{)3100}$ is more than 100 but less than 1000; so you know the answer is a _?_-figure number.

7. If the answer is a 3-figure number, will you write the first quotient figure in hundreds place? Why? You will write it above the _?_ in the dividend.

$$\begin{array}{r} \checkmark\checkmark\checkmark \\ 20\overline{)3100} \end{array}$$

8. Now do the division to find the exact answer. Try to do it without looking at the work below.

$$\begin{array}{r} 155 \\ 20\overline{)3100} \\ \underline{20} \\ 110 \\ \underline{100} \\ 100 \\ \underline{100} \end{array} \qquad \begin{array}{r} \textbf{Check} \\ 155 \\ \underline{\times\ 20} \\ 3100 \end{array}$$

When you finish, compare your work with the work in the box. How many gallons of gasoline are needed? Does the answer check?

9. Tom's father has a car that travels about 25 miles on a gallon of gasoline. Tom estimated that the car would need a little more than _?_ gallons for a 2600-mile trip.

10. If a car travels 22 miles on a gallon of gasoline, how many gallons will be needed to go 3100 miles?

Finding quotients

Are there mistakes in these divisions?

1. $\begin{array}{r} 215\ \text{r}9 \\ 43\overline{)9254} \\ 86 \\ \hline 65 \\ 43 \\ \hline 224 \\ 215 \\ \hline 9 \end{array}$ **2.** $\begin{array}{r} 832\ \text{r}1 \\ 36\overline{)29953} \\ 288 \\ \hline 115 \\ 108 \\ \hline 73 \\ 72 \\ \hline 1 \end{array}$ **3.** $\begin{array}{r} 212\ \text{r}1 \\ 24\overline{)5089} \\ 48 \\ \hline 28 \\ 24 \\ \hline 49 \\ 48 \\ \hline 1 \end{array}$ **4.** $\begin{array}{r} 182\ \text{r}22 \\ 35\overline{)6392} \\ 35 \\ \hline 289 \\ 280 \\ \hline 92 \\ 70 \\ \hline 22 \end{array}$

In each division tell whether there will be a 1-figure, a 2-figure, or a 3-figure quotient.

Next tell where the first quotient figure should be written.

Then estimate the answer. Finally copy, divide, and check.

	a	b	c	d	e
5.	$35\overline{)6392}$	$25\overline{)12926}$	$34\overline{)21320}$	$32\overline{)1099}$	$22\overline{)15876}$
6.	$42\overline{)9126}$	$57\overline{)1520}$	$31\overline{)26877}$	$37\overline{)4334}$	$51\overline{)11526}$
7.	$51\overline{)14484}$	$34\overline{)4250}$	$34\overline{)15170}$	$21\overline{)179}$	$36\overline{)15204}$
8.	$58\overline{)42732}$	$61\overline{)138}$	$24\overline{)10423}$	$32\overline{)3872}$	$32\overline{)10996}$
9.	$82\overline{)33732}$	$93\overline{)58032}$	$57\overline{)42597}$	$71\overline{)1534}$	$48\overline{)24819}$

10. For a Community Supper 1968 rolls are needed. The rolls come wrapped, 2 dozen in a package. How many packages should be ordered?

11. A grocer has shelf space for 3000 cans of fruit. How many cases, each containing 24 cans, will he need to fill this space?

12. Check your answer to Ex. 11 by estimating this way:

▶ In 1 case there are 24 cans. 24 cans is almost 25 cans.

▶ 100 cans would be about 4 cases.

▶ 30 hundred cans would be 30 × 4 cases, or 120 cases.

▶ So I estimate 3000 cans of fruit equal about __?__ cases.

Finishing sentences

After you complete each of the following sentences, make up an easy problem that shows what each sentence means. The problem for the first sentence is made up for you.

1. To find the difference between numbers, you ___?___.

Helen is 10 years old. John is 12 years old. What is the difference between their ages?

2. To find the total of two or more numbers, you ___?___.

3. To find the cost of any number of articles, each marked the same price, you ___?___.

4. You know how many eggs you had and how many you ate.

To find without counting how many eggs are left, you ___?___.

5. You know how many you had at first and how many are left.

To find how many were taken away, you ___?___.

6. You know how many children will come to a party and how many cookies you want for each.

To find how many cookies you need in all, you ___?___.

7. You know how many pennies you have.

To find how many nickels you can get for them, you ___?___.

8. You know how much a book costs and how much money you have.

To find how much more money you need to buy the book, you ___?___.

9. You know how many rows of desks there are in a classroom and how many desks in a row.

To find how many desks there are in the room, you ___?___.

10. You know the total cost of an American flag and how many children are to share the cost.

To find how much each child should pay, you ___?___.

11. You know how much money you have and how much one flashlight battery costs.

To find how many batteries you can buy, you ___?___.

12. You know the date today. To find the date a week from today, you ___?___.

13. You know how many pupils are in your class and how much one songbook costs.

To find the cost of songbooks for all the pupils, you ___?___.

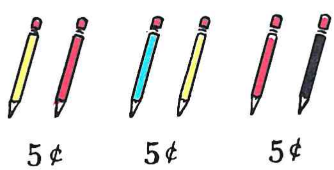
Buying school supplies

The pupils in Miss Brown's fifth-grade class run the Supply Center at Jackson School. Use their sign in the picture to help you answer the problems that follow.

1. Leo wants to buy one each of these colored pencils: green, red, blue, yellow, purple, and black, or __?__ pencils in all. To find how much they cost, he thinks:

"Two pencils cost 5¢, 2 more pencils cost another 5¢, and 2 more pencils cost another 5¢; so the 6 pencils cost 3 × 5¢, or __?__¢."

2. Does this picture show what Leo thinks?



3. Draw a picture to show how much 8 colored pencils cost; 10 colored pencils; 12; 14; 16.

4. How much do 3 erasers cost? 6? 9? a dozen?

5. Find the cost of 4 rulers; 8; 12; 16.

6. "I'd like this ruler, please," said Dotty. She gave the clerk 15¢. The clerk handed her 2¢ change.

How much did Dotty pay for the ruler? Was that the correct amount?

7. How much do 6 memo pads cost? 9? 12? 15?

8. If eight elastic bands cost 10¢, at the same rate you could buy 4 for __?__¢.

9. How much do 24 gummed stickers cost? 36? 48?

10. Can you make a rule for doing Ex. 9?

Dotty said, "First I find the number of 12's in the number of stickers I want to buy. Then I multiply 5¢ by that number."

Show that Dotty's rule is correct.

11. How many erasers can you buy for 20¢? 30¢? 40¢?

12. Can you make a rule for doing Ex. 11?

Leo said, "First I find the number of times 10¢ is contained in the number of cents I have to spend. Then I multiply 3 erasers by that number."

Show that Leo's rule is correct.

13. Tell how much you must pay for:

6 notebooks
4 pencil sharpeners
24 pencils with your name
24 elastic bands

14. How many of each of these can you get for 70¢?

erasers	memo pads
rulers	pencil sharpeners

15. How many of each of these can you get for 75¢?

elastic bands	colored pencils
rulers	pencil sharpeners

16. Tell how much change you get from a dollar if you buy:

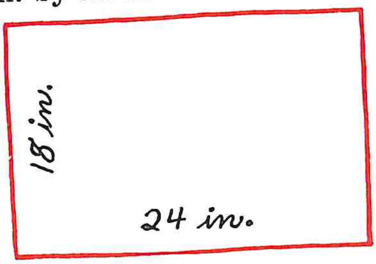
1 doz. pencils with your name
1 doz. memo pads

UNIT 22

Problem-solving helps
Finding averages
Two-step problems

Picturing the problem

1. Carol wanted to find how much rickrack braid she needed to sew around the edge of a cover for her dressing table. The cover is 18 in. by 24 in.

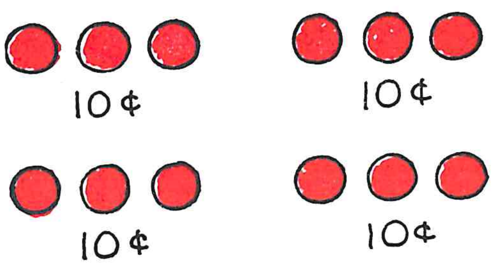


"The cover would be shaped like this," thought Carol, as she drew a rectangle and wrote the dimensions.

Then it was easy for her to see that she needed _?_ inches of rickrack braid.

2. Mike wanted to find the cost of 12 oranges. He knew that oranges were selling at 3 for 10 cents.

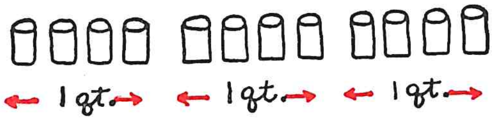
To help him solve the problem, Mike drew this picture:



From the picture, he could see that 12 oranges cost _?_ cents.

3. Judy wondered how many glasses of milk she could get from 3 quarts.

Judy made this picture to help her solve the problem:



Judy could get _?_ glasses of milk from 3 quarts.

4. Tommy was repairing his tent. He wanted to buy a 1-foot piece of canvas that sold for 84 cents a yard.

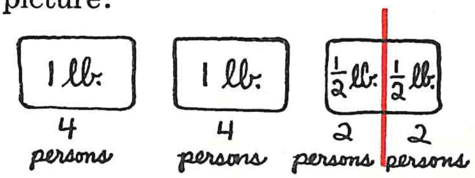
After he drew this picture, he could see that 1 ft. should cost $\frac{1}{3}$ of the cost of a yard, or _?_¢.

5. Alice was solving a map problem which said that 1 inch on the map represented 10 miles. She drew a 2-inch line on her paper.

The line shows that 2 inches represent _?_ miles; $\frac{1}{2}$ inch represents _?_ miles.

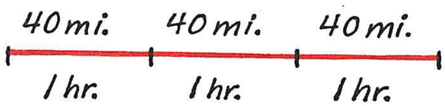
How long a line would Alice draw to represent 30 miles? 35 miles? 50 miles?

6. Jean knows that 1 lb. of hamburger serves 4 persons. To find out how much hamburger to buy for 10 persons, she drew this picture:



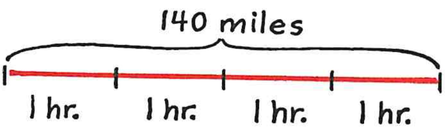
Her drawing shows that for 10 persons she should buy __?__ lb. of hamburger.

7. David wanted to find how far a car would travel in 3 hr. if it traveled at an average rate of 40 miles an hour. He drew this picture.



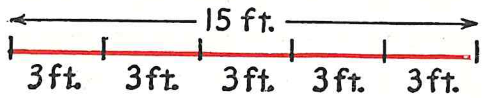
The picture helped him to see that in 3 hr. the car would go __?__ miles.

8. Teddy wanted to solve this problem: If a car traveled 140 mi. in 4 hours, its average rate per hour was __?__ miles.



This is Teddy's picture. It helped him to see that in 1 hour the car traveled $\frac{1}{4}$ of 140 miles, or __?__ miles.

9. Joe needed to change 15 feet to yards. He made this drawing:



The drawing Joe made shows that 15 ft. = __?__ yd.

The number of yards in 15 feet is equal to the number of times that __?__ feet is contained in __?__ feet.

Make up a rule for changing any number of feet to yards.

Draw a picture to represent each problem. Then solve the problem.

10. Find the perimeter of a square $8\frac{1}{2}$ feet on each side.

11. When carrots are selling at "2 bunches for 15 cents," how much should you pay for 6 bunches?

12. John has 3 bushels of potatoes. How many bags, each holding a peck, can he fill?

13. Find the cost of 4 ounces of nuts at 80¢ a pound.

14. If 1 inch on a map represents 5 miles, how many miles do 2 inches represent? 3 inches? $\frac{1}{2}$ inch?

15. At an average rate of 180 miles an hour, how far can an airplane travel in $2\frac{1}{2}$ hours?

Averages

1. Judy spent \$.26 for lunch on Monday, \$.22 on Tuesday, \$.28 on Wednesday, \$.24 on Thursday, and \$.25 on Friday. To find the *average* daily cost of the lunches for the 5 days, she did this work: →

$$\begin{array}{r} \$.26 \\ .22 \\ .28 \\ .24 \\ .25 \\ \hline \$1.25 \end{array} \qquad \begin{array}{r} \$.25 \\ 5\overline{)\$1.25} \end{array}$$

What was the first step in her solution? the second?

If you didn't know the average and were estimating it, would \$.28 be a sensible estimate? Why not? Would \$.22 be a sensible estimate? Why not?

2. In the following examples first estimate the average and then work the example.

In Ex. (*a*), could the average be as low as 18? as large as 28? Is it between 18 and 28? Is it about 24?

(*a*) 24, 18, 24, 28, 26
(*b*) 35, 15, 25, 30, 20
(*c*) 22, 16, 21, 27, 24
(*d*) 75, 80, 90, 75, 85
(*e*) 35, 40, 50, 34, 52
(*f*) 16, 16, 21, 27, 25
(*g*) 16, 12, 20, 24, 18, 14
(*h*) 7, 9, 10, 8, 6, 15
(*i*) 4, 5, 5, 7, 9, 6, 11
(*j*) 3, 8, 7, 9, 6, 6, 6
(*k*) 9, 4, 1, 0, 0, 3, 8

3. Mr. Brown's best cow, Sally, gave these amounts of milk last week: 38 lb., 36 lb., 37 lb., 40 lb., 42 lb., 41 lb., 39 lb.

Find Sally's average daily yield for the week.

4. Mr. Spear's 40 acres of sugar beets yielded 520 bushels. What was the average yield per acre?

5. Dick's 3 acres of peanuts yielded 2,535 pounds, or an average of __?__ pounds per acre.

6. It took Mr. Marvin 6 hours to drive 228 miles. How many miles an hour did he drive on the average?

Does this mean that Mr. Marvin covered exactly 38 miles each hour he drove?

7. Janet spent \$4.80 for materials from which she made 6 stuffed animals. The average cost of each animal was __?__.

8. During the month of April the Weber family used 90 qt. of milk, or an average of __?__ qt. a day.

9. At 18¢ a quart, the Webers' milk bill for April was __?__.

Problems about rate

1. In 4 weeks Jack saved these amounts: 25¢, 75¢, 40¢, 60¢. Did his savings average 50¢ a week?

If Jack saves at the rate of 50¢ a week for 52 weeks, how much will he save in a year?

2. An airplane traveled 1080 miles in 3 hours. What was its average rate per hour?

3. Peter says he can run 200 yards in a minute. Do you think he can run 60 × 200 yards in an hour? Give a reason for your answer.

4. Mr. Swift's car can travel 60 miles an hour. Why should Mr. Swift not plan to cover 180 miles in 3 hours?

5. Miss Evans asked her class to try to write the answers to 80 multiplication facts in 4 minutes.

That would be writing at the rate of __?__ facts a minute.

6. Al's sister timed Al and found that he did 16 multiplication facts in 1 minute.

At this rate, could he do the 80 facts in 4 minutes?

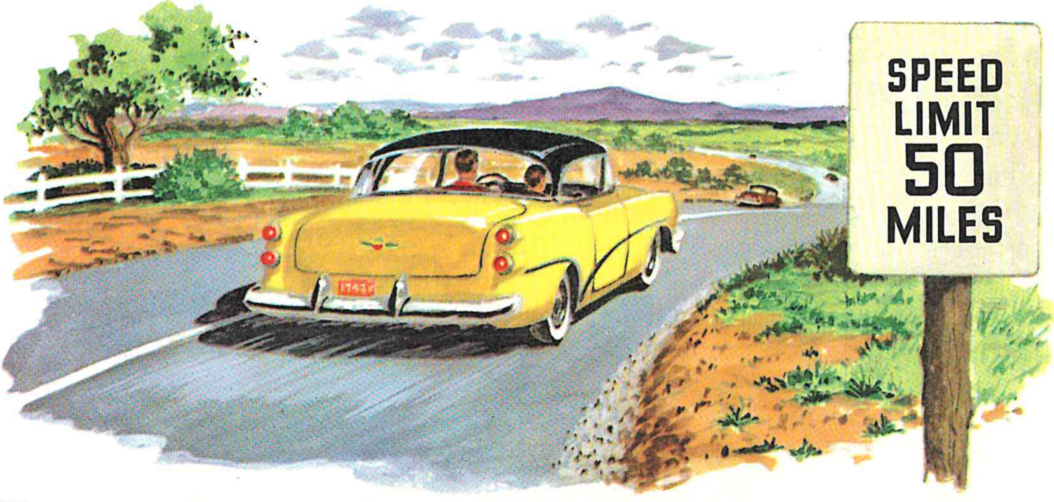
7. Al started again. In the first minute he did 24 facts. In the second minute he did 20 facts. In the third, he did 22.

His average rate for the 3 minutes was __?__ facts a minute.

8. In Ex. 7, was Al working above or below the rate set by Miss Evans? (See Ex. 5.)

9. "Three apples for 10¢," said Joyce, "is paying at the rate of __?__¢ each."

10. Harry and his father are driving from Easton, Pennsylvania, to Erie, Pennsylvania, a distance of 326 miles. Look at the sign. Should they plan to take 6 hr., 7 hr., or 8 hr.? Explain your answer.



Solving two-step problems

1. Tim bought 6 toy airplanes at 15¢ each. How much change should he receive from $1.00?

FIRST STEP: Cost of 6 airplanes = 6 × 15¢ = 90¢.
SECOND STEP: Change = $1.00 − $.90 = __?__.

On your paper write the number of each problem. After each number write the signs which tell how to work the problem. For Ex. 2 you will write: × +

2. Ellen wants 4 yards of gingham at 38¢ a yard and a package of tape for 15¢. How much will both cost?

3. Ann bought rubbers for $1.79 and a rain hat for $1.45.
How much change should she receive from $5.00?

4. Mrs. Warner bought a 6-pound chicken at 39¢ a pound.
How much change should she receive from $3.00?

5. David delivers 6 papers in the morning and 8 in the evening.
How many papers does he deliver in 6 days?

6. Movie tickets for grownups cost 60¢. Children's tickets are half price.
How much will 5 children's tickets cost?

7. Mr. Adams started on a 956-mile trip. The first day he drove 283 miles. The second day he drove 316 miles. The third day he drove 331 miles.
How much farther did he have to go?

8. Jenny bought 50 magazines for $1.00. She sold them for 5¢ each.
How much did she make on all the magazines?

9. Sally needs $1\frac{1}{2}$ yards of chintz to cover the pillows in her room and $\frac{3}{4}$ of a yard of chintz for a dresser scarf.
At 40¢ a yard, how much will the chintz cost?

10. Roy wants to buy 6 yards of plastic garden-hose. At 25¢ a foot, how much will the 6 yards of hose cost?

Now write the solutions for Exs. 2–10 in the same way that the solution to Ex. 1 is written.

Problem study

1. Tom can get a pair of skates for \$3.45. He has saved \$2.97. How much more must he save?

2. Harry measured and found he needs 96 inches of wire to enclose a rabbit run. How many feet of wire does he need?

3. The normal body temperature is $98\frac{6}{10}°$. Robert had a temperature of $101\frac{8}{10}°$.
His temperature was how many degrees above normal?

4. Mary wants a yellow sweater that costs 4 dollars. She can get another sweater that is just like it, but slightly soiled, for \$3.19.
How much can Mary save by buying the soiled sweater?

5. Find the total cost of the 3-cent stamps needed for 198 letters.

6. Grace made $10\frac{1}{2}$ quarts of grape juice last summer. All but $2\frac{1}{2}$ quarts have been used. Can you tell how many quarts have been used?

7. Jane has 50¢. How much more does she need to buy $2\frac{3}{4}$ yards of ribbon at 20¢ a yard?

8. Find the cost of $1\frac{1}{2}$ doz. rolls at 24¢ a dozen, and a 29-cent pie.

9. If the 32 children in a class share equally the task of making 256 garden stakes, how many stakes should each child make?

10. Dan had a roll of wire. He gave $4\frac{1}{2}$ ft. of it to Fred and found he had $5\frac{1}{2}$ ft. left. How many feet of wire had he at first?

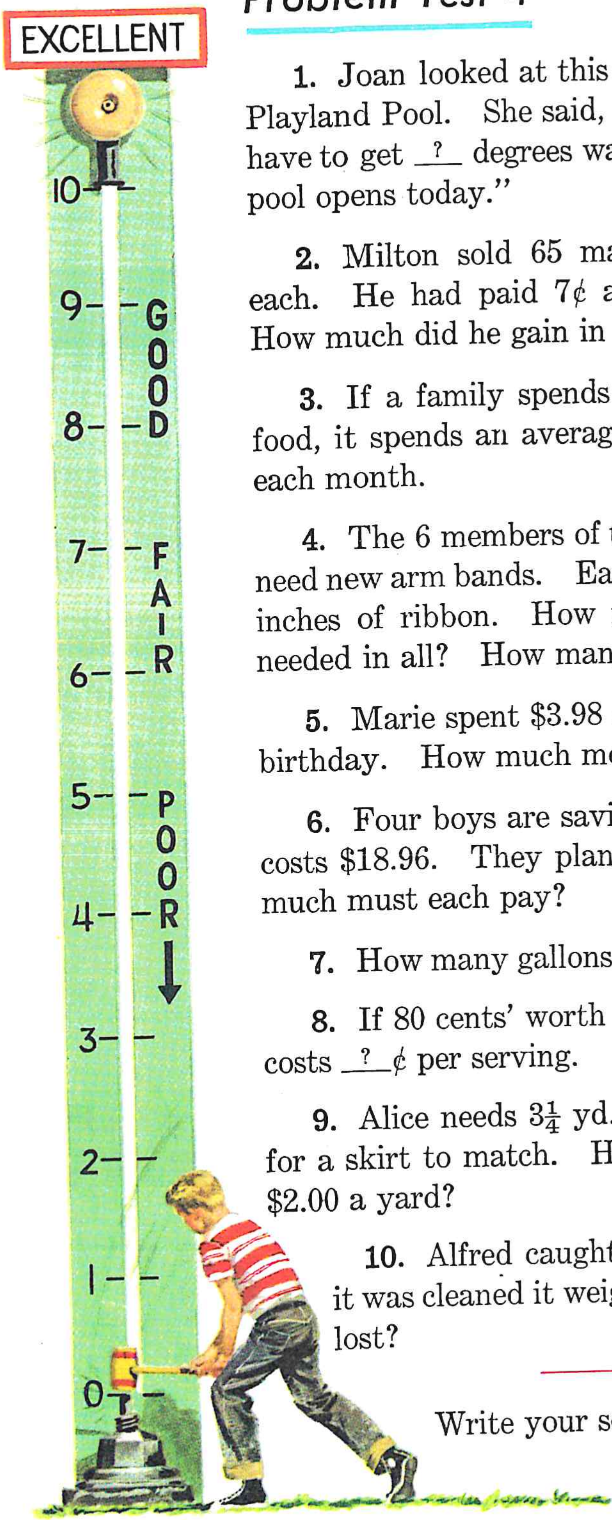
11. Find the cost of $3\frac{3}{4}$ yd. of rayon at \$.80 a yd., 6 buttons at 48¢ a dozen, a 10-cent spool of thread, and a 15-cent zipper.

12. Peter buys a book of 30 bus tickets for \$2.75. Bus fare is 10 cents a ride. How much does he save by buying a book of tickets?

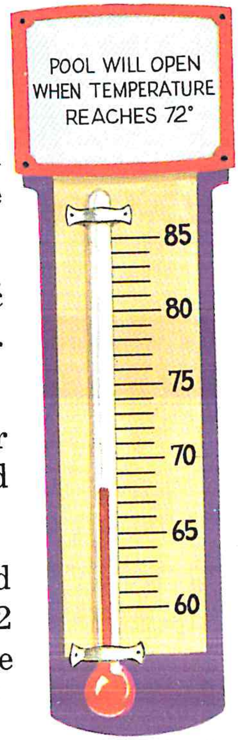
13. Peter uses 2 bus tickets a day (on school days only). How many weeks will his book of 30 tickets last?

14. Draw a line 6 inches long. Use your ruler to divide the line into sections each $\frac{3}{4}$ inch long.
How many $\frac{3}{4}$-inch lengths are there in 6 inches?

15. A 14-oz. package of frozen spinach is equal in food value to $1\frac{1}{2}$ lb. of fresh spinach. Which is the better buy: a 14-oz. package of frozen spinach at 25¢ a package, or fresh spinach at 14¢ a pound?



Problem Test 4



1. Joan looked at this thermometer at Playland Pool. She said, "The water will have to get __?__ degrees warmer before the pool opens today."

2. Milton sold 65 magazines at 10¢ each. He had paid 7¢ apiece for them. How much did he gain in all?

3. If a family spends $684 a year for food, it spends an average of __?__ for food each month.

4. The 6 members of the Traffic Squad need new arm bands. Each band takes 12 inches of ribbon. How many inches are needed in all? How many yards is that?

5. Marie spent $3.98 of the $5 that she received for her birthday. How much money has she left?

6. Four boys are saving money to buy a toboggan that costs $18.96. They plan to share the cost equally. How much must each pay?

7. How many gallons of milk will fill 36 quart bottles?

8. If 80 cents' worth of meat serves 5 persons, the meat costs __?__¢ per serving.

9. Alice needs $3\frac{1}{4}$ yd. of material for a coat and $1\frac{1}{4}$ yd. for a skirt to match. How much will the material cost at $2.00 a yard?

10. Alfred caught a fish that weighed $2\frac{3}{4}$ lb. After it was cleaned it weighed $2\frac{1}{8}$ lb. How much weight was lost?

Write your score on your Problem Test Record.

Self-Help Test 7

Divide and check:

1. $32\overline{)84}$ (80)

2. $34\overline{)7652}$ (173–174)

3. $23\overline{)966}$ (88–92)

4. $63\overline{)5846}$ (96–97)

5. $88\overline{)5956}$ (127–128)

6. $42\overline{)276}$ (81)

7. The Interstate Express averages 45 miles an hour. How many hours will it take to go 225 miles? (85)

8. At 29¢ each, how many pens can Bobby buy for 90¢? (127–128)

9. How many boxes, each holding a dozen eggs, can Max fill with the 1860 eggs he has collected this week? (173–174)

10. At 6 for 5¢, find the cost of 12 erasers. (178)

Self-Help Test 8

1. What is: $\frac{1}{4}$ of 3? $\frac{1}{6}$ of 4? $\frac{1}{8}$ of 5? $\frac{1}{5}$ of 3? (48)

2. Divide: 3 by 5 4 by 7 5 by 7 1 by 6 (48)

3. Find: $\frac{1}{8}$ of 48 $\frac{1}{6}$ of 54 $\frac{1}{9}$ of 63 $\frac{1}{7}$ of 56 (53)

4. What is: $\frac{1}{5}$ of 11 hr.? $\frac{1}{4}$ of 9 in.? $\frac{1}{6}$ of 20 da.? (58)

5. What is: $\frac{3}{4}$ of 24? $\frac{5}{6}$ of 24? $\frac{5}{8}$ of 24? $\frac{3}{10}$ of 40? (108–109)

6. Change to 12ths: $\frac{2}{3}$ $\frac{1}{6}$ $\frac{5}{6}$ $\frac{3}{4}$ $\frac{1}{2}$ $\frac{1}{4}$ $\frac{1}{3}$ (144)

7. Reduce: $\frac{6}{12}$ $\frac{10}{16}$ $\frac{6}{8}$ $\frac{4}{6}$ $\frac{8}{10}$ $\frac{4}{12}$ $\frac{10}{20}$ (148)

8. Add: $\frac{1}{8} + \frac{2}{8}$ $\frac{3}{6} + \frac{1}{6}$ $\frac{5}{8} + \frac{4}{8}$ $\frac{3}{4} + \frac{1}{4}$ (136–137)

9. Add: $\frac{7}{8}$ and $\frac{3}{16}$ $\frac{5}{12}$ and $\frac{1}{6}$ $\frac{3}{5}$ and $\frac{1}{10}$ $\frac{3}{4}$ and $\frac{7}{8}$ (145)

10. Add: $3\frac{1}{2} + 4$ $2\frac{5}{8} + 1\frac{1}{4}$ $3\frac{5}{6} + 2\frac{2}{6}$ $4\frac{7}{8} + 1\frac{1}{2}$ (151)

11. Subtract: $\frac{7}{8} - \frac{1}{8}$ $\frac{9}{12} - \frac{1}{12}$ $\frac{3}{4} - \frac{1}{4}$ $\frac{9}{10} - \frac{1}{10}$ (136–137)

12. Subtract: $\frac{5}{8} - \frac{1}{2}$ $\frac{7}{12} - \frac{1}{3}$ $\frac{5}{6} - \frac{2}{3}$ $\frac{9}{16} - \frac{1}{8}$ (146)

Self-Help Test 9

1. Nancy embroidered a cover for her bureau. Now she wants to buy lace to sew around the 4 edges of the cover. The cover is 34 inches long and 17 inches wide.

Should she buy $1\frac{1}{2}$ yd. of lace? 2 yd.? $2\frac{1}{2}$ yd.? 3 yd.?

How much will the lace cost at 20¢ a yard? **(161–162)**

2. Copy and supply the missing numbers:

(*a*) 10 oz. $= \frac{10}{?}$ lb. $= \frac{?}{?}$ lb.

(*b*) 10 in. $= \frac{10}{?}$ ft. $= \frac{?}{?}$ ft.

(*c*) 9 in. $= \frac{9}{?}$ yd. $= \frac{?}{?}$ yd.

(*d*) 20 min. $= \frac{20}{?}$ hr. $= \frac{?}{?}$ hr.

(*e*) 30 min. $= \frac{30}{?}$ hr. $= \frac{?}{?}$ hr.

(*f*) 30 sec. $= \frac{30}{?}$ min. $= \frac{?}{?}$ min.

(*g*) 4 qt. $= \frac{4}{?}$ pk. $= \frac{?}{?}$ pk.

(*h*) 3 qt. $= \frac{3}{?}$ gal. **(168–169)**

3. Estimate the length of your teacher's desk in feet; estimate its length in inches. **(163)**

4. Change to mixed numbers:

$\frac{7}{4}$ $\frac{12}{5}$ $\frac{17}{3}$ $\frac{23}{10}$ $\frac{19}{8}$ **(124–125)**

5. Give an illustration of:

- an improper fraction.
- a mixed number.
- a proper fraction. **(123)**

6. At 40¢ a pound, 8 oz. of margarine will cost _?_¢.

At 40¢ a dozen, 9 apples will cost _?_¢. **(171)**

7. On the last four Saturdays, Sara earned \$1.80, \$2.40, \$1.50, and \$2.10.

How much did she earn on an average each Saturday? **(180)**

8. Use each of these words correctly in a sentence:

average **(181)**	rectangle **(161)**
perimeter **(161)**	square **(162)**
dimensions **(161)**	estimate **(163)**

9. Find the cost of $2\frac{3}{4}$ pounds of meat at 48¢ a pound. **(110)**

10. Find the difference between $8\frac{5}{12}$ and $2\frac{1}{3}$. **(152)**

11. Write in Arabic numerals:

XIX XLV LXIV **(27–28)**

12. Using a scale of $\frac{1}{2}$ inch to a mile, draw a line to represent 4 miles. **(164)**

13. If a motorcycle policeman travels at a rate of 60 miles an hour, how long will it take him to go 75 miles? **(181)**

14. In the fraction $\frac{11}{12}$ name the denominator. **(121)**

Measuring your growth in arithmetic

Work carefully. Check your answers. Be sure your answers are sensible.

1. On a certain map $\frac{1}{4}''$ represents a distance of a mile. What distance does a line $2''$ long represent on the map? Make a diagram to help you.

2. Find the perimeter of a rectangle $2' \times 5'$. Make a diagram to help you.

3. Joanne wants 8 pears. How much must she pay for them if the sign reads, "Pears: 2 for 5¢"? Draw a picture.

4. Copy and complete:

4 gallons = __?__ quarts
2 feet = __?__ inches
$\frac{1}{4}$ tons = __?__ pounds
$\frac{3}{4}$ tons = __?__ pounds

5. 3 ounces = what part of a pound?

6. Mary needs $12''$ of ribbon for an arm band. How much will this amount of ribbon cost her at 18¢ a yard?

7. Kathryn saved \$30 in a Christmas Club last year. Did her savings average \$$2\frac{1}{2}$ a month during the year?

8. Find the average of 44, 25, 18, 30, 28.

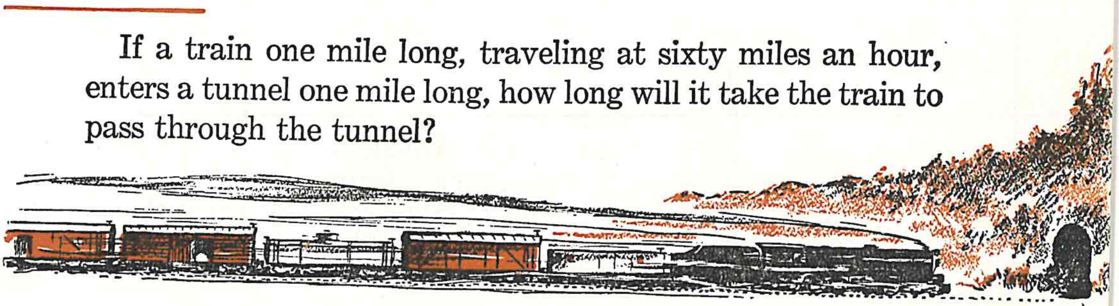
9. Mr. Peters planned to make a trip of 750 mi. in 3 days. He traveled 275 mi. on the first day and 215 mi. on the second.

How far did he have to travel on the third day?

10. An airplane traveled 2205 miles in 7 hours of flying time. What was its average rate of speed per hour?

Just for fun

If a train one mile long, traveling at sixty miles an hour, enters a tunnel one mile long, how long will it take the train to pass through the tunnel?



UNIT 23

Zero in the quotient. Dividing money. Apparent quotient figure too large. Estimating quotients

Zero in the quotient

1. The 1060 pupils in the Elm Street School are divided into 10 equal Safety-First Groups.

Without help can you find out how many pupils there are in each group?

2. To find the answer to Ex. 1, Tom thought, "10 times *what number of pupils* equals 1060; or $10 \times N = 1060$." How can Tom find what number N stands for?

3. Estimate how many figures there will be in the quotient of Tom's division: $10\overline{)1060}$

4. Tom said, "The answer to $10\overline{)1060}$ will be *just a little more* than 100." How could he tell that?

5. The table below shows how two boys divided 1060 by 10. Explain the work of each.

6. Use Tom's way to find how many children there will be in each Safety-First Group:

- if 1177 children are divided into 11 groups. $(1177 = 1100 + 77)$
- if 2205 children are divided into 21 groups. (Does $2205 = 2100 + 105$?)

7. Now use Bill's way to do the divisions in Ex. 6.

Do these by Tom's way; by Bill's:

8. $32\overline{)3264}$ $24\overline{)4872}$ $20\overline{)8160}$

9. $33\overline{)9966}$ $32\overline{)3392}$ $25\overline{)7600}$

<table>
<tr><th rowspan="2">TOM'S WAY</th><th colspan="3">BILL'S WAY
He wrote this to remind him to put 3 figures in the quotient: → $\begin{array}{r} \checkmark\checkmark\checkmark \\ 10\overline{)1060} \end{array}$</th></tr>
<tr><th>First Step</th><th>Second Step</th><th>Third Step</th></tr>
<tr><td>$1060 = 1000 + 60$

$1000 \div 10 = 100$
$60 \div 10 = \underline{6}$
so $1060 \div 10 = 106$</td><td>$\begin{array}{r} 1\checkmark\checkmark \\ 10\overline{)1060} \\ \underline{10} \end{array}$

Divide to find the figure in hundreds place. How many 10's in 10?</td><td>$\begin{array}{r} 10\checkmark \\ 10\overline{)1060} \\ \underline{10}{\downarrow} \\ 6 \end{array}$

Divide to find the figure in tens place. How many 10's in 6?</td><td>$\begin{array}{r} 106 \\ 10\overline{)1060} \\ \underline{10}{\downarrow\downarrow} \\ 60 \\ \underline{60} \end{array}$

Divide to find the figure in ones place. How many 10's in 60?</td></tr>
</table>

Practice with zeros in the quotient

Copy Exs. 1–3 without the work; next, divide. Then look at the book to see if your work is right. Then check each answer.

1. $\begin{array}{r} 308 \\ 32\overline{)9856} \\ \underline{96} \\ 256 \\ \underline{256} \end{array}$ **2.** $\begin{array}{r} 204 \\ 36\overline{)7344} \\ \underline{72} \\ 144 \\ \underline{144} \end{array}$ **3.** $\begin{array}{r} 408\text{ r1} \\ 56\overline{)22849} \\ \underline{224} \\ 449 \\ \underline{448} \\ 1 \end{array}$

Tell how many figures there will be in each quotient below. Also tell where you will write the first quotient figure.

Next tell how you find the first quotient figure. (Use the Hint System.)

Then estimate the answer. Finally copy, divide, and check.

	a	b	c	d	e
4.	25)5075	32)9859	51)20716	61)30999	54)11056
5.	63)12743	35)7232	42)8663	65)13546	56)11638
6.	44)9056	46)9558	63)31960	74)37642	64)19607
7.	66)33462	49)24857	83)41767	92)37074	56)22556
8.	57)23083	75)45639	57)34632	46)18650	34)10383

If you had difficulty with Exs. 4 to 8, do these:

	a	b	c	d	e
9.	89)62390	83)74921	78)62831	93)56031	87)52587
10.	96)67296	79)39621	34)27339	38)26831	79)47779
11.	87)60987	58)46816	75)30254	86)34753	95)76558
12.	79)63372	78)62498	68)41007	97)58298	89)71840

Final zero in the quotient

The girls in a sewing class are going to make aprons to wear in a play. Below is the number of inches of muslin needed by each girl in the three groups in the class:

JANE'S GROUP	SUE'S GROUP	ANNE'S GROUP
23	23	24
23	23	23
25	25	25
24	26	27
27	24	25

1. How many inches of muslin are needed by Jane's group? Sue's group? Anne's group?

How many inches are needed by the whole class?

Before reading on, see if you can figure how many *yards* are needed by the whole class.

2. To find how many yards of muslin the whole class needs, Jane thought like this: "*Some number of yards* $\times$ 36 in. = 367 in."

She wrote: $N \times 36 = 367$. How can she find what number N stands for?

3. Tell how you estimate how many figures there will be in the quotient of Jane's division: $36\overline{)367}$

4. Would you estimate the quotient to be close to 10? Why?

5. The table below shows how Jane and Sue divided 367 by 36. Explain the work of each. How are their divisions alike? different?

Did each girl find the class needs 10 yd. 7 in. of muslin? Prove that this answer is correct.

<table>
<tr><td>JANE'S WAY</td><td colspan="2">SUE'S WAY
She wrote this to remind her to put 2 figures in the quotient: → $\begin{array}{r} \surd\surd \\ 36\overline{)367} \end{array}$</td></tr>
<tr><td></td><td>First Step</td><td>Second Step</td></tr>
<tr><td>$\begin{array}{r} 10 \\ 36\overline{)367} \\ \underline{360} \\ 7 \end{array}$

Ans. 10 r7</td><td>$\begin{array}{r} 1\surd \\ 36\overline{)367} \\ \underline{36} \end{array}$

Divide to find the figure in tens place. How many 36's in 36?</td><td>$\begin{array}{r} 10 \\ 36\overline{)367} \\ \underline{36\downarrow} \\ 7 \end{array}$ Ans. 10 r7

Divide to find the figure in ones place. How many 36's in 7?</td></tr>
</table>

Practice with final zeros in the quotient

Exs. 1–4 are worked for you. Copy them without the work and divide. Then look to see if your work is correct. Check each answer.

1. $$\begin{array}{r} 210 \\ 28\overline{)5880} \\ \underline{56} \\ 28 \\ \underline{28} \\ 0 \end{array}$$

2. $$\begin{array}{r} 520 \text{ r}5 \\ 36\overline{)18725} \\ \underline{180} \\ 72 \\ \underline{72} \\ 5 \end{array}$$

3. $$\begin{array}{r} 60 \text{ r}22 \\ 64\overline{)3862} \\ \underline{384} \\ 22 \end{array}$$

4. $$\begin{array}{r} 670 \text{ r}17 \\ 21\overline{)14087} \\ \underline{126} \\ 148 \\ \underline{147} \\ 17 \end{array}$$

Tell how many figures there will be in each quotient below. Also tell where you will write the first quotient figure.

Next tell how to find the first quotient figure. (Use the Hint System.)

Then estimate the answer. Finally copy, divide, and check.

	a	b	c	d	e
5.	$29\overline{)1160}$	$24\overline{)7296}$	$27\overline{)546}$	$28\overline{)847}$	$28\overline{)5656}$
6.	$63\overline{)28987}$	$75\overline{)1500}$	$93\overline{)3720}$	$39\overline{)1958}$	$75\overline{)51032}$
7.	$48\overline{)966}$	$35\overline{)1418}$	$21\overline{)1050}$	$21\overline{)12187}$	$53\overline{)1060}$
8.	$32\overline{)1921}$	$37\overline{)17413}$	$75\overline{)6007}$	$32\overline{)2240}$	$48\overline{)1942}$
9.	$43\overline{)3011}$	$43\overline{)30195}$	$87\overline{)4350}$	$43\overline{)3035}$	$76\overline{)5327}$
10.	$84\overline{)7570}$	$56\overline{)4487}$	$37\overline{)2981}$	$54\overline{)3240}$	$63\overline{)3795}$
11.	$78\overline{)3906}$	$55\overline{)2762}$	$65\overline{)4562}$	$76\overline{)6083}$	$67\overline{)4038}$
12.	$64\overline{)3840}$	$35\overline{)16110}$	$22\overline{)14753}$	$43\overline{)2603}$	$54\overline{)3794}$
13.	$43\overline{)2593}$	$76\overline{)3800}$	$57\overline{)20532}$	$68\overline{)3421}$	$34\overline{)2742}$

Sharing costs

1. The Student Council of Wildwood School has voted that the whole school help to buy an encyclopedia set that costs \$64.40.

There are 8 classes in the school. If the 8 classes share the cost equally, how much should each class pay?

2. There are 35 children in one class. Each child wants to give his share toward the new books.

How much will each need to give in order to raise \$8.05?

Estimate the answer. Would 10¢ apiece be enough for each to give? Would 20¢ apiece be enough? Would 30¢ apiece be too much?

3. This is the way Ben divided to find how much each of the 35 children should pay:→

Wrong

$$\begin{array}{r} 23 \\ 35\overline{)\$8.05} \\ 70 \\ \hline 105 \\ 105 \\ \hline \end{array}$$

Ben said, "Each child should give 23 dollars."

"That's silly," said Jean. "The whole class is going to give only \$8.05. You forgot to write the dollar sign and cents point in your answer."

After Ben wrote the dollar sign and cents point, what was his answer? How much should each child pay? Never make the mistake Ben did.

Remember to write the dollar sign and cents point in your answer whenever they are needed. Write the dollar sign just above the dollar sign in the dividend. Write the cents point just above the cents point in the dividend.

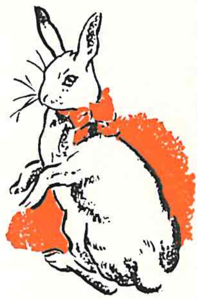
First estimate each answer. Then divide and check.

	a	b	c	d	e
4.	$33\overline{)\$17.49}$	$42\overline{)\$7.14}$	$22\overline{)\$4.65}$	$41\overline{)\$7.85}$	$41\overline{)\$9.02}$
5.	$20\overline{)\$8.40}$	$51\overline{)\$115.30}$	$71\overline{)\$153.50}$	$52\overline{)\$78.00}$	$35\overline{)\$44.00}$
6.	$36\overline{)\$72.36}$	$54\overline{)\$108.54}$	$64\overline{)\$79.86}$	$75\overline{)\$150.75}$	$25\overline{)\$28.00}$
7.	$37\overline{)\$74.37}$	$63\overline{)\$252.63}$	$72\overline{)\$120.96}$	$54\overline{)\$124.20}$	$20\overline{)\$43.20}$

Dividing money by money

"Let's earn our \$8.05 for the encyclopedias by having a pet show," said Patsy. "We could charge 25¢ a ticket."

"How many tickets would we have to sell?" asked Sue. "We'll have to find how many times 25¢ goes into \$8.05. \$8.05 equals 805¢."



"We can find how many tickets we need to sell by dividing 805 by 25," said Patsy.

Was Patsy right? Do this division: $25\overline{)805}$

Patsy said they would have to sell 32 tickets, and somebody would have to give an extra nickel. Prove that she is right.

1. How many tickets at 35¢ each would a class have to sell to make \$8.05?

How many at 30¢ each? at 20¢ each?

2. At 15¢ a dozen, how many dozen cookies can you buy for \$1.95. Do this division: $15\overline{)195}$

3. How many 35-cent violin strings can you buy for \$4.90? Do this division: $35\overline{)490}$

4. How many 25-cent cans of dog food can you buy for \$1.50? (How many 25's are there in 150?)

5. How many 39-cent lilac bushes can you buy for \$2.00? (How many 39's are there in 200?)

Will you have any money left? How much?

6. How many 35-cent rolls of film can you buy for \$6.30? (How many 35's are there in 630?)

7. How many 45-cent typewriter ribbons can you buy for \$7.50?

Will you have any money left? How much?

8. How many 75-cent puppets can you buy for \$9.00?

How much will you have left?

9. How many 21-cent baby chicks can you buy for \$5.00?

How much will you have left?

10. How many 45-cent tickets can you buy for \$3.00?

How much will you have left?

11. Some pupils earned \$4.50 with which to buy tennis balls. The balls cost 65¢ each.

How many tennis balls can the pupils get?

How much money will they have left over?

Arithmetic roundup

Oral review

	a	*b*	*c*	*d*	*e*	*f*
1.	$2 \div 3$	$\frac{1}{3}$ of 8	$\frac{1}{5}$ of 3	$5 \div 3$	$\frac{3}{4} + \frac{3}{4}$	$\frac{1}{2} + \frac{1}{4}$
2.	$\frac{7}{8} + \frac{1}{2}$	$2\frac{3}{4} + 3$	$\frac{7}{8} - \frac{1}{8}$	$\frac{7}{8} - \frac{1}{2}$	$\frac{1}{2} - \frac{1}{6}$	$4\frac{3}{4} - \frac{1}{2}$

3. Tell the numerator and denominator of: $\frac{3}{4}$ $\frac{4}{5}$ $\frac{1}{2}$ $\frac{5}{6}$ $\frac{5}{8}$

4. Change to mixed numbers: $\frac{7}{3}$ $\frac{7}{4}$ $\frac{11}{6}$ $\frac{13}{2}$ $\frac{10}{3}$

5. Change to whole numbers: $\frac{5}{5}$ $\frac{9}{3}$ $\frac{12}{4}$ $\frac{6}{6}$ $\frac{10}{2}$

6. What part of a dozen eggs is: 2 eggs? 3 eggs? 4? 6? 8? 9?

7. On the blackboard draw a diagram to show that $\frac{3}{4} = \frac{6}{8}$; that $2\frac{3}{4} = \frac{11}{4}$.

8. How many ounces of salted peanuts are there in:

a $\frac{1}{4}$-lb. pkg.? a $\frac{1}{2}$-lb. pkg.? a $\frac{3}{4}$-lb. pkg.?

Written review

1. Ruth has \$28.35 in the bank. She adds 55¢ to it this week and 55¢ next week.

How much will she then have?

2. How much will 30 copies of *Songs by Stephen Foster* cost at 35¢ each?

3. Eight boys spent 96¢ for "hot dogs" and rolls.

What is each boy's share of the expense?

4. Mr. Stevens bought $3\frac{1}{3}$ yd. of wire screening at 45¢ a yard.

How much did he pay for it?

5. \$143 + \$86 + \$289 + \$368

6. \$.34 + \$.79 + \$.73 + \$.66

	a	*b*	*c*
7.	$\begin{array}{r}\$2000\\ -\ 899\\ \hline\end{array}$	$\begin{array}{r}\$845.45\\ -\ 795.36\\ \hline\end{array}$	$\begin{array}{r}\$40.00\\ -\ 38.56\\ \hline\end{array}$
8.	$\begin{array}{r}\$5.09\\ \times\ 47\\ \hline\end{array}$	$\begin{array}{r}\$768\\ \times\ 500\\ \hline\end{array}$	$\begin{array}{r}275\\ \times\ 509\\ \hline\end{array}$
9.	$8\overline{)\$768}$	$6\overline{)\$12.54}$	$34\overline{)4250}$

10. Take the tests on pages 305, 306, 307, and 308.

You must be sure you know these number facts.

Problem study

1. Janet is knitting a sweater. The sleeves are to be $16\frac{1}{2}$ in. long.

She has knit $9\frac{1}{4}$ in. on one sleeve. How many more inches must she knit on that sleeve?

2. John says his baby brother is 27 months old. How many years old is he?

3. The normal body temperature is $98\frac{6}{10}°$. Today Jack's temperature was $97\frac{1}{2}°$.

His temperature was how many degrees below normal?

4. Albert can buy a tool chest for $5.40 or make one for $3.98. How much can he save by making the chest himself?

5. If a school sells 1250 tickets at 15¢ each, how much money will it take in?

6. A big icicle outside a classroom window was $18\frac{3}{4}$ in. long on February first. On March first it was only $6\frac{1}{2}$ in. long.

How many inches had melted away?

7. Miss Day's class paid $5.44 for a wall map. If the 34 children in the class share the cost, how much should each child pay?

8. Dorothy received two dollars for her birthday. How much more does she need to buy $3\frac{3}{4}$ yd. of dress material at $.80 a yard?

9. Find the cost of $2\frac{3}{4}$ yd. of gingham at 40¢ a yard, and a 10-cent card of buttons.

10. If you know how many marbles you gave away and how many you have left, how can you find how many you had at first?

11. If you know how many feet long a rope is, how can you find how many yards long it is? Give an illustration.

12. Find the perimeter of a rectangle $2\frac{1}{2}$ inches long and $1\frac{1}{4}$ inches wide.

13. If 8 boys share 3 bricks of ice cream, will each boy get more than a whole brick, nearly a whole brick, or less than half a brick?

14. How many 12-cent goldfish can you buy for $.50? How much money will you have left over?

15. If you know how many quarts of paint you need for a fence, how can you find the number of gallon cans of paint to buy? Illustrate.

Finding the right quotient figure

1. Anne finds that she will need 210 inches of brown cambric to make a Pioneer Girl costume. How many yards will she need? How many inches more?

$36\overline{)210}$

Anne wrote down the example and thought, "3 in 21, 7 times." She tried 7. Why wouldn't 7 do? Would 6 do? Would 5?

2. 168 children are going to the museum to see Pioneer Costumes. One bus can take 28 children. How many buses will be needed?

$28\overline{)168}$

Is 8 the correct quotient figure for the example in the box at the right? Try 7. Try 6.

Here is a rule that will help you in finding quotient figures:

> **Try the quotient figure that seems right. If it is too large, try the next smaller number. If that is too large, try the next smaller number, and so on, until you find the right one.**

Estimate the quotient figures in these examples. Then work each example.

	a	*b*	*c*	*d*	*e*	*f*
3.	$78\overline{)613}$	$29\overline{)187}$	$53\overline{)468}$	$28\overline{)140}$	$54\overline{)487}$	$27\overline{)172}$
4.	$49\overline{)306}$	$77\overline{)645}$	$17\overline{)69}$	$28\overline{)198}$	$19\overline{)67}$	$29\overline{)105}$
5.	$27\overline{)118}$	$96\overline{)725}$	$86\overline{)629}$	$59\overline{)413}$	$28\overline{)107}$	$34\overline{)268}$
6.	$18\overline{)56}$	$78\overline{)606}$	$58\overline{)410}$	$68\overline{)523}$	$19\overline{)58}$	$26\overline{)185}$

	a	*b*	*c*	*d*	*e*
7.	$645 \div 15$	$3607 \div 48$	$7734 \div 15$	$1429 \div 27$	$564 \div 36$
8.	$2773 \div 37$	$1446 \div 39$	$2051 \div 36$	$7256 \div 89$	$382 \div 48$
9.	$4368 \div 56$	$185 \div 37$	$3661 \div 69$	$1507 \div 39$	$309 \div 49$

Problems and practice

1. At this time next year John wants to buy the accordion in the picture.

How much must John save every week for a year?

2. A Cub Pack of 21 boys is giving a dinner that costs $14.75.

How much should each boy pay?

How many of the boys have to pay 1¢ extra?

3. At 25¢ each, how many presents can Peter buy for $1.40?

Will there be any money left?

4. At 15¢ a dozen, how many dozen rolls can be bought for 65¢?

Will there be any money left?

5. Ann has $3.00. She wants to knit a sweater that takes $5\frac{1}{2}$ balls of yarn.

Ann can buy one kind of yarn for 49¢ a ball, or a better kind for 59¢ a ball.

Does Ann have enough money to buy the better yarn? the poorer yarn? (Remember that she cannot buy a part of a ball of yarn.)

Divide and check:

	a	*b*	*c*	*d*	*e*
6.	$26\overline{)1857}$	$28\overline{)1598}$	$19\overline{)586}$	$28\overline{)1463}$	$27\overline{)1393}$
7.	$59\overline{)3585}$	$16\overline{)843}$	$25\overline{)142}$	$26\overline{)1566}$	$38\overline{)2900}$
8.	$16\overline{)560}$	$57\overline{)3875}$	$49\overline{)2814}$	$29\overline{)1875}$	$28\overline{)1500}$

A page of practice

1. Changing the 6 to an 8 in 1,609,009 makes the number _?_ greater.

2. Add $9\frac{1}{2}$ and $11\frac{6}{10}$.

3. From $8\frac{3}{4}$ subtract $5\frac{7}{12}$.

4. Reduce to lowest terms:

$\frac{6}{8}$ $\quad \frac{9}{12}$ $\quad \frac{14}{16}$ $\quad \frac{6}{10}$ $\quad \frac{2}{4}$ $\quad \frac{4}{6}$

5. Change to whole or mixed numbers:

$\frac{18}{5}$ $\quad \frac{22}{3}$ $\quad \frac{7}{2}$ $\quad \frac{12}{4}$ $\quad \frac{23}{10}$ $\quad \frac{25}{8}$

6. At 18¢ a gallon, how much will 16 gal. of gasoline cost?

7. The *Flier*, an express train, makes a 372-mile run in 6 hr. It travels at an average rate of _?_ miles an hour.

8. Joan wants to cover 12 shelves with paper. Each shelf takes two pieces of paper each 24 in. long.

Joan has a 10-yd. piece of shelf paper. Is it long enough to cover the 12 shelves? (10 yd. = _?_ in.)

9. Shirley needs $2\frac{5}{8}$ yd. of chintz for a costume and Anne needs $2\frac{3}{4}$ yd.

How many yards do the girls need in all?

10. Sue needs $1\frac{1}{4}$ yd. of muslin for trimming her costume, and Doris needs $1\frac{1}{8}$ yd.

If Miss Fry cuts the muslin for the girls from a piece $8\frac{3}{4}$ yd. long, how much will be left in the piece?

Can you find the missing numbers in these examples?

11. $\begin{array}{r} 4 \\ 5 \\ ? \\ 9 \\ 8 \\ \hline 31 \end{array}$ **12.** $\begin{array}{r} 24 \\ 85 \\ 63 \\ ?7 \\ 54 \\ \hline 293 \end{array}$ **13.** $\begin{array}{r} 4021 \\ ????\\ \hline 1578 \end{array}$ **14.** $\begin{array}{r} \$806.24 \\ ???.??\\ \hline \$324.57 \end{array}$

15. $\begin{array}{r} 492 \\ 7\overline{)344?} \end{array}$ **16.** $\begin{array}{r} ?67 \\ 6\overline{)520?} \end{array}$ **17.** $\begin{array}{r} ?2 \\ 76\overline{)471?} \end{array}$ **18.** $\begin{array}{r} \$.?0 \\ 58\overline{)\$34.8?} \end{array}$

19. $\begin{array}{r} 275 \\ ? \\ \hline 1650 \end{array}$ **20.** $\begin{array}{r} 4?5 \\ 9 \\ \hline 3?45 \end{array}$ **21.** $\begin{array}{r} ?8? \\ 5 \\ \hline 3415 \end{array}$ **22.** $\begin{array}{r} ??? \\ 6 \\ \hline 3804 \end{array}$

Estimating quotients

Do not work the divisions in Exs. 1–3. Just tell these things about each quotient:

- How many figures will there be in the quotient? Explain how you find this answer.
- Where should the first figure of each quotient be placed?
- Estimate the first quotient figure. Be sure to test your estimate to see if it works.
- Estimate the whole quotient. Say it like this: The quotient is "50 some"; or the quotient is "500 and some"; and so on.

	a	b	c
1.	34)700	24)1256	54)4432
2.	54)436	23)1732	43)9846
3.	25)765	32)9725	37)1152

4. Miss Blake gave her pupils this division and asked them to estimate the quotient: 52)1215.

Following are the estimates of John, June, and Bill. Study each method until you are sure you understand it.

① John said, "52 is about 50; in 1 hundred there are about *2* fifties; so in 12 hundred there are about 12 × *2* fifties, or *24* fifties. The quotient is about 24."

② June said, "I know the quotient is a 2-figure number because 1215 is more than 10 × 52 and not so much as 100 × 52.

"The first quotient figure is 2, so I estimate the quotient to be *20 some*."

③ Bill made up this table to find how many 52's there are in 1215:

10 × 52 = 520	
20 × 52 = 1040	← 1215
30 × 52 = 1560	

He said, "1215 comes between the 1040 and the 1560; so there must be between 20 and 30 fifty-twos in 1215.

"1215 is closer to 1040 than it is to 1560; so the quotient will be closer to 20 than to 30. I estimate that it is less than 25."

Whose way do you like best: John's, June's, or Bill's?

Estimate the following quotients by John's method; by June's; by Bill's. Which way is easiest for you?

	a	b	c
5.	12)374	21)1834	33)1749
6.	25)500	25)5050	52)7800
7.	36)288	32)9859	21)8406

No pencils, please!

	a	b	c
1.	1 ft. = ? in.	$\frac{2}{3}$ ft. = ? in.	$\frac{3}{4}$ ft. = ? in.
2.	1 yd. = ? ft.	$\frac{1}{3}$ yd. = ? ft.	$\frac{2}{3}$ yd. = ? ft.
3.	1 yd. = ? in.	$\frac{3}{4}$ yd. = ? in.	$\frac{2}{3}$ yd. = ? in.
4.	1 mi. = ? ft.	$\frac{1}{2}$ mi. = ? ft.	$\frac{1}{4}$ mi. = ? ft.
5.	1 min. = ? sec.	$\frac{1}{2}$ min. = ? sec.	$\frac{1}{4}$ min. = ? sec.
6.	1 hr. = ? min.	$\frac{3}{4}$ hr. = ? min.	$\frac{5}{6}$ hr. = ? min.
7.	1 yr. = ? mo.	$\frac{1}{4}$ yr. = ? mo.	$\frac{2}{3}$ yr. = ? mo.
8.	1 T. = ? lb.	$\frac{1}{2}$ T. = ? lb.	$\frac{1}{4}$ T. = ? lb.
9.	1 lb. = ? oz.	$\frac{5}{8}$ lb. = ? oz.	$\frac{7}{8}$ lb. = ? oz.
10.	1 gal. = ? qt.	$\frac{1}{2}$ gal. = ? qt.	$\frac{3}{4}$ gal. = ? qt.
11.	1 bu. = ? pk.	$\frac{1}{2}$ bu. = ? pk.	$\frac{1}{4}$ bu. = ? pk.
12.	1 pk. = ? qt.	$\frac{1}{2}$ pk. = ? qt.	$\frac{3}{4}$ pk. = ? qt.

13. 10 minutes is what part of an hour?

14. 4 ounces is what part of a pound?

15. 3 inches is what part of a foot?

16. 11:40 P.M. means ? minutes of ? in the ?.

17. 48 in. = ? yd. ? in.
48 in. = ? yd. ? ft.

18. Jerry earns 45¢ an hour cutting the lawn. Last Saturday he worked 40 minutes. What part of an hour did he work?

How much should he have been paid?

19. How much will 27 in. of material cost at 40¢ a yard?

20. Name in order the months of the year. Tell how many days there are in each month.

Using arithmetic

1. In going from Cleveland to Duluth, Mary Lou had to change trains in Chicago.

She arrived in Chicago at 11:32 A.M. and left at 2:05 P.M.

She had to wait in Chicago _?_ hours and _?_ minutes.

2. Fred went to a grange picnic with his family. This is the way he estimated how many people were eating their supper:

- There are 12 rows of picnic tables.
- There are 9 tables in a row.
- There are about 10 people at each table.
- So there must be about a _?_ people eating their picnic supper.

3. One day it took John and Jerry 8 minutes to saw a log into 3 pieces.

How long would it take them to saw a log of the same size into 4 pieces if each cut took the same amount of time?

This is tricky. Draw a picture of the problem.

4. An airplane due to arrive in Detroit at 10:45 arrived at 11:17.

The plane was _?_ minutes late.

5. See if you can tell from the picture how to finish this sentence:

Barbara is reading Volume number _?_ in the set.

How is the Volume number written on her book?

Keeping up in division

1. Don was doing the division $96\overline{)4735}$. He decided the quotient was a 2-figure number. Do you agree?

To find the first quotient figure, Don used the Hint System: How many 9's in 47? Then he wrote 5 in tens place.

How did Don discover that 5 is too large? What should he do next? Do the division.

Wrong

$$\begin{array}{r} 5 \\ 96\overline{)4735} \\ \underline{480} \end{array}$$

Tell how many figures there will be in each quotient in Exs. 2–10. Find the first quotient figure in each division. Estimate each quotient. Then divide and check.

	a	*b*	*c*	*d*	*e*
2.	$34\overline{)6246}$	$66\overline{)3276}$	$82\overline{)6806}$	$57\overline{)2009}$	$57\overline{)2465}$
3.	$96\overline{)4735}$	$25\overline{)6758}$	$66\overline{)1259}$	$92\overline{)7728}$	$92\overline{)4734}$
4.	$93\overline{)5952}$	$83\overline{)6142}$	$28\overline{)578}$	$32\overline{)1329}$	$63\overline{)4933}$
5.	$49\overline{)826}$	$45\overline{)2646}$	$61\overline{)4938}$	$38\overline{)2084}$	$78\overline{)3850}$
6.	$27\overline{)1995}$	$29\overline{)1874}$	$39\overline{)2360}$	$48\overline{)36094}$	$38\overline{)2166}$
7.	$46\overline{)3312}$	$18\overline{)2242}$	$46\overline{)30105}$	$35\overline{)7055}$	$36\overline{)7565}$
8.	$25\overline{)5025}$	$45\overline{)901}$	$36\overline{)7344}$	$37\overline{)11494}$	$32\overline{)8859}$
9.	$94\overline{)40436}$	$53\overline{)1080}$	$37\overline{)139}$	$26\overline{)10654}$	$36\overline{)8344}$
10.	$26\overline{)1651}$	$26\overline{)1597}$	$88\overline{)5997}$	$59\overline{)1892}$	$18\overline{)5624}$

11. At 49¢ each, how many books can you buy for $10.00?

How much money will you have left over?

12. Mrs. Jones bought a set of 24 books for $29.76. What was the average price of each book?

13. The Smiths' grocery bill for August was $45.57. Their groceries cost an average of __?__ a day.

14. 28 pupils share equally the $30.80 cost of a school movie screen.

Each pupil should pay __?__.

Can you solve these problems?

1. Bob has \$2.10 to spend for books. The ones he wants cost 35¢ each.

Bob wonders how many books he can buy. Can you find out?

2. The Burkes are driving from Oregon to Maryland, a distance of about 3000 miles. They plan to drive about 40 miles an hour.

They figure it will take 75 hours of driving. Do you agree?

3. If the Burkes (Ex. 2) drive 9 hours a day, about how many days will it take them to make the trip?

4. Jane is buying a box containing 100 vitamin tablets for \$2.00. She can get a box containing 25 tablets for \$.60.

How much is Jane saving by buying the 100 tablets in the large-size box?

5. One store sells an 8-pound bar of modeling clay for \$1.60. Another store sells 5-pound bars of the same kind of clay for \$1.20.

At which store is the clay cheaper? (Find the cost of 1 pound at each store.)

6. How many pounds of bananas at 15¢ a pound can you buy for \$5.00?

7. The dog food John usually buys costs 18¢ a can. Tomorrow the store will have a sale, selling 2 dozen cans of that kind of dog food for \$4.15.

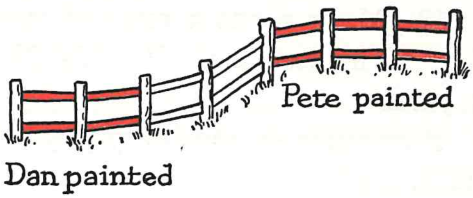
How much money can John save if he buys 2 dozen cans of dog food at the sale?

8. How many 25-cent gifts can you buy with \$3.00?

9. \$79.68 is to be divided equally among 24 persons. How much will each one get?

Is your answer reasonable? How can you prove that your answer is correct?

10. Dan and Pete are painting the rails in the fence in front of their house.



They started at opposite ends and have painted as much as is shown in the drawing.

- What part has Pete painted?
- What part have both boys painted all together?
- What part must still be painted?

A page of review

1. $\begin{array}{r} 58\\ 187\\ 99\\ 23\\ \underline{385} \end{array}$ $\qquad$ $\begin{array}{r} \$\ .94\\ .67\\ 2.84\\ .95\\ \underline{.76} \end{array}$ $\qquad$ $\begin{array}{r} \$1.47\\ 2.79\\ .96\\ 3.64\\ \underline{1.88} \end{array}$

2. $\begin{array}{r} 6603\\ \underline{-\ 5095} \end{array}$ $\qquad$ $\begin{array}{r} \$\ 7.00\\ \underline{-\ 1.94} \end{array}$ $\qquad$ $\begin{array}{r} \$6.85\\ \underline{\times\ 58} \end{array}$

3. $6\overline{)4608}$ $\qquad$ $7\overline{)703}$ $\qquad$ $8\overline{)3928}$

4. Divide 25396 by 28.

5. Divide 33735 by 39.

6. Add \$8.55, \$4.82, and \$54.60.

7. From \$1.17 take 89¢.

8. From $8\frac{4}{5}$ take $\frac{1}{10}$.

9. Find the cost of $\frac{3}{4}$ yd. of ribbon at 48¢ a yard.

10. Mary needs a piece of ribbon 12 inches long. It costs 39¢ a yard.
How much should Mary pay for 12 inches?

11. How many 30-cent films can Jack buy for \$1.20?

12. In the last 4 weeks George earned these amounts: \$2.40, \$3.00, \$2.50, and \$1.70.
Did his earnings average \$2.50 a week?

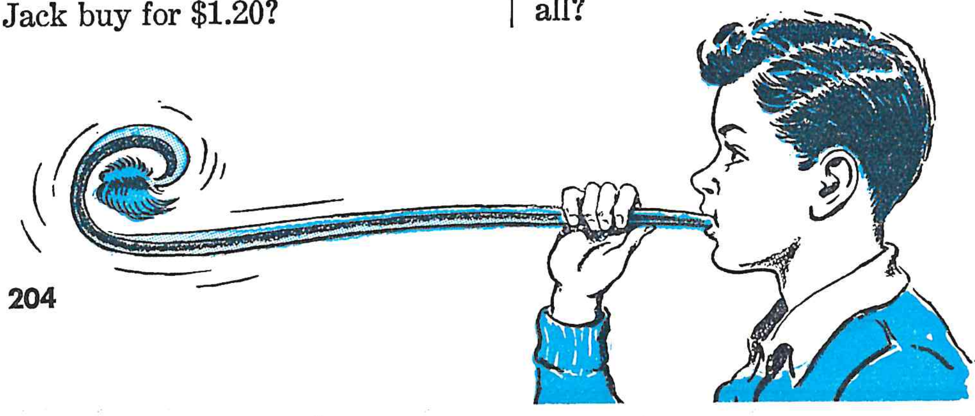
13. Jane is making gelatin pudding. Will a quart bowl hold the pudding if the recipe calls for $2\frac{1}{4}$ cups of boiling water, $\frac{1}{4}$ cup of cold water, and $\frac{1}{2}$ cup of fruit juice?

14. Find the cost of $3\frac{1}{2}$ lb. of candy at 70¢ a pound.

15. Harry has a cardboard $6\frac{3}{4}$ in. wide. If he cuts off a strip $2\frac{1}{2}$ in. wide, how wide will the remaining piece be?

16. Ruth cut a piece of gingham $1\frac{5}{8}$ yd. long from a piece $3\frac{3}{4}$ yd. long. How much gingham was left?

17. Ed paid \$4 for a box of 50 "Blow Hard" ticklers like the one below. He sold 38 ticklers at 10¢ each and the rest at 9¢ each.
How much did Ed make in all?



Comparing populations

Read this table. Then estimate the answers in Exs. 1–6.

STATE	POPULATION
California	10,586,223
Illinois	8,712,176
New York	14,830,192
North Carolina . . .	4,061,929
Pennsylvania	10,498,012

1. Which states have a population of about 15 million? about 11 million?

2. Which two states on the above list have approximately equal populations?

3. About how many more millions of people live in New York than in Illinois?

4. Which two states together have a population about equal to that of New York?

5. Which state has about twice the population of North Carolina?

6. What is the population of your state?

Compare it in as many different ways as you can with the populations given in the table on this page.

Roman numerals

1. Read these Roman numerals. They go from 10 to 200 by 10's.

X XX XXX XL L LX LXX LXXX XC C

CX CXX CXXX CXL CL CLX CLXX CLXXX CXC CC

2. What numbers do these Roman numerals stand for?

I V X IV XI L C XL XC LXV XCII

3. C = _?_, XX = _?_, II = _?_, so CXXII = _?_.

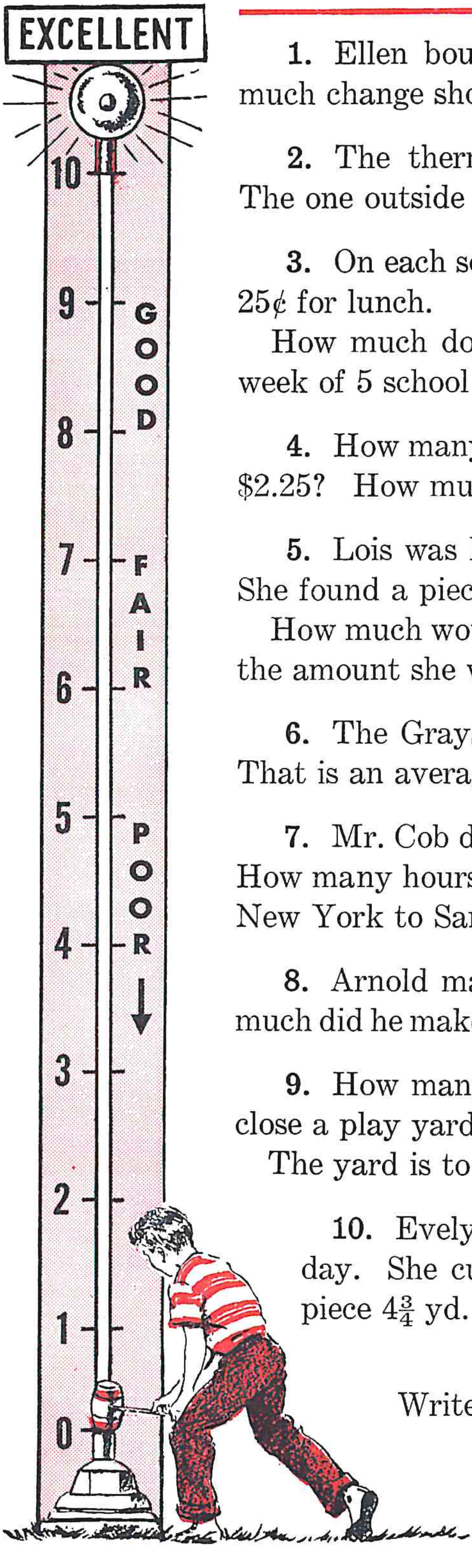
4. CC = _?_, XL = _?_, IV = _?_, so CCXLIV = _?_.

5. CC = _?_, XC = _?_, I = _?_, so CCXCI = _?_.

6. C = _?_, XC = _?_, III = _?_, so CXCIII = _?_.

7. Ask your teacher to dictate some numbers between 10 and 200. See if you can write them in Roman numerals.

Problem Test 5



1. Ellen bought 3 lb. of nuts at 59¢ a pound. How much change should she have received from \$2?

2. The thermometer in the living room showed 65°. The one outside showed 12°. It was _?_° colder outside.

3. On each school day, Allan spends 16¢ for carfare and 25¢ for lunch.

How much does Allan spend for carfare and lunch in a week of 5 school days?

4. How many tennis balls at 35¢ each can Roy buy with \$2.25? How much money will he have left?

5. Lois was looking at some goods marked 39¢ a yard. She found a piece 3 yd. long marked \$1.00.

How much would she save by buying the piece if that was the amount she wanted?

6. The Grays' electric-light bill for January was \$6.51. That is an average of _?_¢ a day.

7. Mr. Cob drives at an average speed of 40 mi. an hour. How many hours of driving should he expect on a trip from New York to San Francisco, a distance of 3040 miles?

8. Arnold makes 6¢ on every magazine he sells. How much did he make on the 40 magazines he sold last Saturday?

9. How many feet of wire fencing will Joe need to enclose a play yard for his baby brother?

The yard is to be 20 ft. long and $12\frac{3}{4}$ ft. wide.

10. Evelyn is making an apron for her mother's birthday. She cut a piece of gingham $1\frac{5}{8}$ yd. long from a piece $4\frac{3}{4}$ yd. long. How much was left?

Write your score on your Problem Test Record.

Finding missing numbers mentally

Find the missing numbers in Exs. 1–6. In Ex. 1 say, "Some number, N, added to 28 makes 100. So N = 100 − 28, or _?_."

	a	*b*	*c*	*d*
1.	$N + 28 = 100$	$N \div 8 = 7$	$N + 1 = 1\frac{7}{8}$	$4\frac{1}{2} - N = 3\frac{3}{4}$
2.	$37 + N = 100$	$1 - N = \frac{1}{8}$	$N + 3\frac{1}{2} = 5$	$50 \div N = 25$
3.	$2\frac{3}{4} + N = 4$	$2 - N = \frac{1}{4}$	$N \div 5 = 15$	$N \times 6 = 50$
4.	$100 - N = 40$	$N + \frac{3}{4} = 1$	$3\frac{3}{8} - N = 3$	$10 - N = 2\frac{1}{2}$
5.	$N \times 25 = 500$	$1 - N = \frac{1}{3}$	$5 - N = 2\frac{3}{4}$	$4 - N = 3\frac{1}{8}$
6.	$N \times 50 = 200$	$5 - N = \frac{1}{2}$	$N \div 6 = 3\frac{1}{2}$	$50 \div N = 10$

7. When Tom was learning to find quotient figures, he practiced on the examples below.

In which examples is his estimated quotient figure too large?

(*a*) $\begin{array}{r} 3 \\ 25\overline{)7565} \\ \underline{75} \end{array}$ (*b*) $\begin{array}{r} 5 \\ 68\overline{)3397} \\ \underline{340} \end{array}$

(*c*) $\begin{array}{r} 5 \\ 56\overline{)2919} \\ \underline{280} \end{array}$ (*d*) $\begin{array}{r} 6 \\ 39\overline{)2318} \\ \underline{234} \end{array}$

8. Estimate the answers to each division in Ex. 7.

9. Bill said, "If you add a 2-place number to a 4-place number, the sum could be either a 4-place or a 5-place number." Illustrate Bill's idea.

10. Lois listened to Bill (Ex. 9) and made up this rule:

"If you subtract a 2-place number from a 4-place number, the difference could be a 4-place number or a 3-place number." Was Lois right?

11. Can you make up a rule like those in Exs. 9 and 10 about multiplication? about division?

12. Which gives the larger quotient: $37\overline{)800}$ or $27\overline{)800}$?

13. Which of these fractions is greater than 1?

$\frac{5}{8}$ $\frac{8}{5}$ $\frac{3}{2}$ $\frac{3}{4}$ $\frac{4}{3}$ $\frac{8}{8}$ $\frac{6}{5}$ $\frac{15}{12}$

14. Which is larger:

$\frac{3}{4}$ or $\frac{2}{3}$? $\frac{7}{8}$ or $\frac{3}{4}$? $\frac{9}{10}$ or $\frac{4}{5}$?

Comparing numbers

John has saved 5 dollars and his younger sister Mary has saved 3 dollars. Which of the statements in Exs. 1–11 about their savings are true?

1. John has saved 2 dollars more than Mary.

2. Mary has saved 2 dollars less than John.

3. The difference in John's savings and Mary's savings is 2 dollars.

4. In Exs. 1–3, you compared their savings by subtraction.

5. John has saved $\frac{5}{3}$ as much as Mary.

6. John has saved $1\frac{2}{3}$ times as much as Mary.

7. Mary has saved $\frac{3}{5}$ as much as John.

8. In Exs. 5–7, you compared their savings by division.

9. When you compare a smaller number with a larger number by division, your answer is a proper fraction.

10. When you compare a larger number with a smaller number by division, your answer is an improper fraction or a mixed number.

11. Mary will always save $\frac{3}{5}$ as much as John.

John is 6 feet tall and Mary is 5 feet tall. Which of the statements in Exs. 12–20 about their heights are true?

12. John is 1 foot taller than Mary.

13. Mary is 1 foot shorter than John.

14. You can compare their heights by subtraction and also by division.

15. The difference in their heights is 1 foot.

16. Some day Mary will be 1 foot taller than John.

17. Mary is $\frac{5}{6}$ as tall as John.

18. John is $1\frac{1}{5}$ times as tall as Mary.

19. If you divide Mary's height by John's height, you get $\frac{5}{6}$.

20. If you divide John's height by Mary's height, you get $\frac{6}{5}$, or $1\frac{1}{5}$.

Self-Help Test 10

1. $\frac{3}{4} + \frac{5}{8}$ **(145–148)** 2. $\frac{7}{12} - \frac{5}{12}$ **(136–137)** 3. $4\frac{1}{4} + 5\frac{1}{4}$ **(151)**

4. $\frac{2}{3} - \frac{1}{6}$ **(146–148)** 5. $3\frac{7}{10} - 1\frac{1}{5}$ **(152)** 6. $2\frac{7}{8} + 3\frac{1}{4}$ **(151)**

7. Find $\frac{1}{8}$ of 320; of 248; of 440. **(53)**

8. Find $\frac{5}{6}$ of 30 in.; of 48 in.; of 60 in. **(108–109)**

9. Find $\frac{1}{5}$ of 31; of 17; of 47. **(58)**

10. Change to 16ths: $\frac{5}{8}$ $\frac{3}{4}$ $\frac{1}{2}$ $\frac{3}{8}$ **(144)**

11. Change to mixed numbers: $\frac{21}{5}$ $\frac{17}{3}$ $\frac{35}{4}$ **(124–125)**

12. Reduce to lowest terms: $\frac{9}{12}$ $\frac{6}{8}$ $\frac{3}{12}$ $\frac{8}{16}$ **(148)**

13. $1\frac{3}{4}$ doz. = ___?___; $1\frac{1}{2}$ doz. = ___?___; $2\frac{1}{3}$ doz. = ___?___. **(110)**

14. $1\frac{1}{4}$ yd. = ___?___ in.; $1\frac{1}{3}$ yd. = ___?___ in.; $1\frac{3}{4}$ yd. = ___?___ in. **(110)**

15. If you divide 6 bars of modeling clay equally among 8 boys, what part of a bar of clay will each boy receive? **(48–49)**

16. Find the cost of $\frac{3}{4}$ lb. of Sing-A-Song Canary Seed at 80¢ a pound. **(108–109)**

17. Find the cost of $2\frac{3}{4}$ yd. of rayon at 60¢ a yard. **(110)**

18. Marie is making 24 bows, each requiring 9 in. of ribbon. How many yards of ribbon does she need to buy? **(127–129)**

19. Bobby wants to buy 4 cup cakes. If the cakes sell for 36¢ a dozen, how much will 4 cakes cost? **(171)**

20. Find the average of: 45, 24, 43, 56, 42, and 60 **(181)**

21. The noon temperature on Monday was 18°, on Tuesday 25°, on Wednesday 16°, on Thursday 20°, and on Friday 24°.

What was the average noon temperature? **(181)**

22. Tom's grandfather bought Tom a fishing rod for \$2.49, a reel for \$1.75, a roll of fish line for 39¢, and a dozen hooks at 3 for 10¢.

What was the total cost of Tom's fishing equipment? **(9)**

23. Compare a quarter with a dollar by subtraction. Now compare them by division. **(208)**

Self-Help Test 11

Divide and check:

1. $25\overline{)7565}$ **(188–189)**
2. $45\overline{)9090}$ **(188–189)**
3. $39\overline{)2358}$ **(190)**
4. $67\overline{)3398}$ **(190)**
5. $86\overline{)\$775.48}$ **(192)**
6. $67\overline{)\$47.20}$ **(192)**
7. $95\overline{)\$480.82}$ **(192)**
8. $24\overline{)5280}$ **(191)**
9. $56\overline{)1919}$ **(96–97)**

10. Copy these numbers and place commas correctly:

20700634 456862031 **(7)**

11. If you arrange 50 pennies in piles of 3 pennies, how many piles will you have and how many pennies will be left over? **(59–61)**

12. Is the fraction $\frac{8}{8}$ an improper fraction? **(123)**

13. How many 75-cent victrola records can Ed buy for $8.00? **(193)**

14. If N $\times$ 21 = 672, what number does N stand for? **(70)**

Self-Help Test 12

Divide and check:

1. $15\overline{)639}$ **(196)**
2. $35\overline{)\$242.50}$ **(192)**
3. $46\overline{)18650}$ **(189)**
4. $29\overline{)1624}$ **(196)**
5. $8\overline{)3112}$ **(62–63)**
6. $5\overline{)\$51.20}$ **(63)**

7. The Clark twins received a set of 24 reference books for their birthday. If the set cost $42.96, what was the average cost of each book? **(192)**

8. Lou paid $1.08 for a 25-lb. bag of grain for his chickens.

Was the cost per pound about 4¢, 5¢, or 8¢? **(163)**

9. If Al finds how many 20's there are in 200 by subtracting 20 over and over, how many subtractions must he do? (Do not use a pencil to help find this answer.) **(78)**

10. At 40 miles an hour, how many hours will it take Ted to go from his home to South Bend, a distance of 160 miles? **(81)**

Measuring your growth in arithmetic

Work carefully. Check your answers. Be sure your answers are sensible.

1. Robert saves 35¢ a week. How long will it take him to save enough to buy a brief case marked $4.90?

2. Edgar's family is moving to Hillsdale, 280 miles away. The driver of the moving van told Edgar that the movers would travel at about 35 mi. an hour.

If the movers leave at 11 A.M., will they be in Hillsdale at 7 P.M.?

3. A large ocean liner carries 2,302 persons, including the crew. It carries 24 lifeboats, each lifeboat having places for 96 persons.

Is there a place in the lifeboats for each person?

4. If CC stands for _?_, and XL stands for _?_, and VIII stands for _?_, then CCXLVIII stands for _?_.

5. At 75¢ each, how many books can a group of boys buy with $6? ($6 = _?_¢.)

6. The 15 classes in Central School plan to share equally the cost of a new school radio.

If the radio costs $225, how much should each class pay?

Divide and check:

7. $94\overline{)\$660.50}$ **8.** $36\overline{)7236}$

9. $46\overline{)29929}$ **10.** $71\overline{)42009}$

Just for fun

Tell whether these statements are ***always*** *true,* ***sometimes*** *true, or* ***never*** *true. Give illustrations to prove your answers.*

1. The dimensions of a rectangle are unequal.

2. The numerator of a fraction is smaller than its denominator.

3. Any odd number plus 1 equals an even number.

4. A whole number minus a fraction equals a mixed number.

5. If you know the answer to a subtraction, and the subtrahend, you can find the minuend.

6. If a fraction has the same number for its numerator and its denominator, then that fraction is equal to 1.

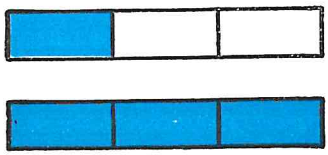
7. An improper fraction and a whole number have an equal value.

UNIT 25

More practice with fractions, reducing to lowest terms, adding and subtracting, fractions in quotient, improper fractions and mixed numbers

Oral practice with fractions

1. What part of the first bar below is colored? What part is not colored?



2. In the fraction $\frac{2}{3}$, 2 is the ___?___; 3 is the ___?___.

3. The number in a fraction that tells into how many equal parts an object is divided is called the ___?___.

4. The number in a fraction that tells how many of the equal parts you are thinking about is called the ___?___.

5. What part of the first bar in Ex. 1 is colored? What kind of fraction is your answer?

6. A proper fraction is ___?___ than a whole; its numerator is ___?___ than the denominator. Name three proper fractions.

7. What part of the second bar in Ex. 1 is colored? What kind of fraction is your answer?

8. How many thirds are colored in the two bars together? What kind of fraction is your answer?

9. An improper fraction is equal to or ___?___ than a whole; its numerator is equal to or ___?___ than the denominator.

10. Name some proper fractions; some improper fractions.

11. Look at the bars in Ex. 1. $\frac{4}{3}$ = what mixed number?

12. Change to whole or mixed numbers: $\frac{6}{3}$ $\frac{5}{3}$ $\frac{9}{4}$ $\frac{9}{2}$. Illustrate with drawings.

13. Which of these fractions ($\frac{1}{2}$ $\frac{2}{4}$ $\frac{2}{8}$ $\frac{1}{8}$) is half as large as $\frac{1}{4}$? Which are twice as large as $\frac{1}{4}$?
Draw a diagram to illustrate your answers.

14. Which of these fractions ($\frac{1}{6}$ $\frac{2}{6}$ $\frac{4}{6}$ $\frac{4}{3}$) is twice as large as $\frac{2}{3}$? Which is half as large as $\frac{2}{3}$?
Draw a diagram to illustrate.

15. 4 tens + 3 tens = ___?___ tens.
4 *tenths* + 3 *tenths* = ___?___ *tenths.*
$\frac{4}{10} + \frac{3}{10} = \frac{?}{10}$.

Fractions whose denominators are alike are called ***like fractions.***

16. In adding or subtracting *like fractions,* you should add or subtract the ___?___, but never add or subtract the ___?___.

17. Fractions cannot be added unless they have the same __?__. This denominator is called a *common denominator.*

18. When you add $\frac{1}{2}$ and $\frac{1}{4}$, you must first think, "For halves and fourths the common denominator is __?__."

$$\frac{1}{2} = \frac{?}{4} \qquad \frac{2}{4} + \frac{1}{4} = \frac{?}{4}$$

19. When you subtract $\frac{1}{4}$ from $\frac{3}{8}$, you must first think, "For fourths and eighths the common denominator is __?__."

$$\frac{1}{4} = \frac{?}{8} \qquad \frac{3}{8} - \frac{2}{8} = \frac{?}{8}$$

20. What common denominator would you use in solving each of these?

$$\frac{7}{8} - \frac{1}{2} \qquad \frac{3}{10} + \frac{1}{2} \qquad \frac{5}{12} - \frac{1}{3}$$

21. To change $\frac{1}{2}$ to 10ths, you think and say:
"A whole = *10* tenths.
"$\frac{1}{2} = \frac{1}{2}$ *of 10* tenths = __?__ tenths."

22. Here are two ways to change $\frac{2}{3}$ to 6ths. Explain each way. Which way do you like better?

- $\begin{cases} \text{A whole} = 6 \text{ sixths.} \\ \frac{1}{3} = \frac{1}{3} \text{ of } 6 \text{ sixths} = 2 \text{ sixths.} \\ \frac{2}{3} = 2 \times 2 \text{ sixths} = 4 \text{ sixths.} \end{cases}$
- $\frac{2}{3} = \frac{2 \times 2}{2 \times 3} = \frac{4}{6}$

23. Here are two ways to change $\frac{2}{3}$ to 12ths. Explain each way.

- $\begin{cases} \text{A whole} = 12 \text{ twelfths.} \\ \frac{1}{3} = \frac{1}{3} \text{ of } 12 \text{ twelfths} = 4 \text{ twelfths.} \\ \frac{2}{3} = 2 \times 4 \text{ twelfths} = \underline{\ ?\ } \text{ twelfths.} \end{cases}$
- $\frac{2}{3} = \frac{4 \times 2}{4 \times 3} = \frac{8}{12}$

Tell what you think and say to find the missing numerators:

	a	b	c	d	e
24.	$\frac{1}{4} = \frac{?}{12}$	$\frac{3}{4} = \frac{?}{8}$	$\frac{2}{5} = \frac{?}{10}$	$\frac{1}{3} = \frac{?}{12}$	$\frac{5}{8} = \frac{?}{16}$
25.	$\frac{2}{3} = \frac{?}{12}$	$\frac{2}{3} = \frac{?}{6}$	$\frac{4}{5} = \frac{?}{10}$	$\frac{5}{6} = \frac{?}{12}$	$\frac{3}{5} = \frac{?}{10}$
26.	$\frac{7}{8} = \frac{?}{16}$	$\frac{1}{3} = \frac{?}{6}$	$\frac{6}{8} = \frac{?}{16}$	$\frac{1}{4} = \frac{?}{16}$	$\frac{3}{8} = \frac{?}{16}$
27.	$\frac{5}{5} = \frac{?}{10}$	$\frac{1}{2} = \frac{?}{8}$	$\frac{1}{5} = \frac{?}{10}$	$\frac{3}{4} = \frac{?}{12}$	$\frac{1}{6} = \frac{?}{12}$

Add:

28.	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{5}{10}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{5}{8}$
	$\frac{1}{8}$	$\frac{1}{10}$	$\frac{3}{8}$	$\frac{1}{12}$	$\frac{1}{5}$	$\frac{5}{16}$	$\frac{1}{8}$	$\frac{1}{4}$

Equal fractions

1. Betty added $\frac{1}{4} + \frac{1}{6} + \frac{1}{12}$ by thinking, "$\frac{1}{4}$ is 3 twelfths and $\frac{1}{6}$ is 2 twelfths. So $\frac{1}{4} + \frac{1}{6} + \frac{1}{12}$ is 3 twelfths + 2 twelfths + 1 twelfth, or 6 twelfths."

Was Betty's thinking correct?

2. Then Betty changed $\frac{6}{12}$ (her answer in Ex. 1) to $\frac{3}{6}$ by dividing both numerator and denominator by __?__.

3. Jim said, "$\frac{3}{6}$ is not in lowest terms. You can still divide both terms of the fraction $\frac{3}{6}$ by __?__, and get $\frac{1}{2}$." Does $\frac{6}{12} = \frac{1}{2}$?

4. Here are two ways to reduce $\frac{8}{16}$ to *lowest terms.* Which is shorter? Which do you prefer?

- $\dfrac{8 \div 4}{16 \div 4} = \dfrac{2}{4} \qquad \dfrac{2 \div 2}{4 \div 2} = \dfrac{1}{2}$
- $\dfrac{8 \div 8}{16 \div 8} = \dfrac{1}{2}$

Reduce to lowest terms all that are not already in lowest terms:

	a	*b*	*c*	*d*	*e*	*f*	*g*
5.	$\frac{5}{8}$	$\frac{6}{8}$	$\frac{7}{8}$	$\frac{3}{4}$	$\frac{2}{6}$	$\frac{3}{6}$	$\frac{4}{6}$
6.	$\frac{8}{10}$	$\frac{4}{12}$	$\frac{5}{12}$	$\frac{6}{12}$	$\frac{7}{12}$	$\frac{8}{12}$	$\frac{6}{16}$
7.	$\frac{10}{16}$	$\frac{7}{14}$	$\frac{9}{12}$	$\frac{3}{10}$	$\frac{6}{10}$	$\frac{5}{16}$	$\frac{8}{16}$

Reduce to lowest terms. Tell the largest number by which both the numerator and the denominator can be divided evenly.

	a	*b*	*c*	*d*	*e*	*f*	*g*
8.	$\frac{4}{10}$	$\frac{4}{16}$	$\frac{5}{10}$	$\frac{8}{12}$	$\frac{10}{16}$	$\frac{6}{10}$	$\frac{12}{16}$

In the following examples reduce answers to lowest terms:

9. $\frac{3}{8} + \frac{1}{8}$ 10. $\frac{1}{3} + \frac{4}{12}$ 11. $\frac{2}{5} + \frac{1}{10}$ 12. $\frac{4}{12} + \frac{1}{6}$

13. You can change a fraction to an equal fraction by:

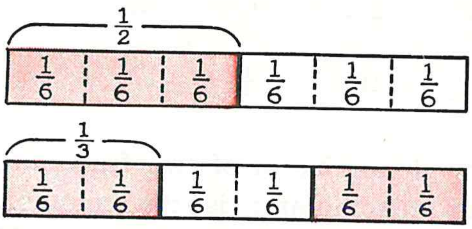
- multiplying its numerator and its denominator by the same number. Illustrate.
- dividing its numerator and its denominator by the same number. Illustrate.

Smallest common denominators

Julia and Carol are making toy animals. Julia needs $\frac{1}{2}$ yd. of flannel for a monkey. Carol wants to buy $\frac{1}{3}$ yd. of the same material for a dog.

How much flannel should they buy? Can you add $\frac{1}{2}$ and $\frac{1}{3}$?

▶ Julia looked at the fractions $\frac{1}{2}$ and $\frac{1}{3}$ and thought, "I can't add these; they are *unlike fractions.* I'll have to change them to *like fractions.*" What did she mean? Would this diagram help her?



The diagram shows that $\frac{1}{2} = \frac{?}{6}$; $\frac{1}{3} = \frac{?}{6}$; so $\frac{1}{2} + \frac{1}{3} = \frac{3}{6} + \frac{2}{6}$, or $\frac{?}{6}$.

The girls will need $\underline{\ ?\ }$ yd. of flannel.

▶ Carol said, "We don't need a diagram to add $\frac{1}{2}$ and $\frac{1}{3}$." She wrote:

(*a*) $\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8} = \frac{5}{10} = \frac{6}{12}$

(*b*) $\frac{1}{3} = \frac{2}{6} = \frac{3}{9} = \frac{4}{12}$

Does Carol's work show that halves and thirds can both be changed to 4ths? 6ths? 8ths? 9ths? 10ths? 12ths?

If Carol changes $\frac{1}{2}$ and $\frac{1}{3}$ to sixths and adds, she gets $\frac{3}{6}+\frac{2}{6}=\frac{5}{6}$.

If she changes both $\frac{1}{2}$ and $\frac{1}{3}$ to twelfths, she gets $\frac{6}{12}+\frac{4}{12}=\frac{10}{12}=\frac{5}{6}$.

Carol said, "Additions like this are easier if you use the ***smallest common denominator.***"

Show that Carol is right.

1. To find $\frac{1}{2} + \frac{1}{3}$, think:

$\frac{1}{2} = \frac{?}{6}$; $\quad \frac{1}{3} = \frac{?}{6}$; $\quad \frac{3}{6} + \frac{2}{6} = \frac{?}{6}$

2. To find $\frac{1}{3} + \frac{1}{4}$, think:

$\frac{1}{3} = \frac{?}{12}$; $\quad \frac{1}{4} = \frac{?}{12}$; $\quad \frac{4}{12} + \frac{3}{12} = \frac{?}{12}$

3. To find $\frac{1}{2} - \frac{1}{3}$, think:

$\frac{1}{2} = \frac{?}{6}$; $\quad \frac{1}{3} = \frac{?}{6}$; $\quad \frac{3}{6} - \frac{2}{6} = \frac{?}{6}$

4. To find $\frac{1}{2} - \frac{1}{5}$, think:

$\frac{1}{2} = \frac{?}{10}$; $\quad \frac{1}{5} = \frac{?}{10}$; $\quad \frac{5}{10} - \frac{2}{10} = \frac{?}{10}$

5. To find $\frac{2}{3} - \frac{1}{2}$, think:

$\frac{2}{3} = \frac{?}{6}$; $\quad \frac{1}{2} = \frac{?}{6}$; $\quad \frac{4}{6} - \frac{3}{6} = \frac{?}{6}$

6. To find $\frac{3}{4} - \frac{1}{3}$, think:

$\frac{3}{4} = \frac{?}{12}$; $\quad \frac{1}{3} = \frac{?}{12}$; $\quad \frac{9}{12} - \frac{4}{12} = \frac{?}{12}$

7. To find $\frac{3}{4} - \frac{2}{3}$, think:

$\frac{3}{4} = \frac{?}{12}$; $\quad \frac{2}{3} = \frac{?}{12}$; $\quad \frac{9}{12} - \frac{8}{12} = \frac{?}{12}$

8. To find $\frac{4}{5} - \frac{1}{2}$, think:

$\frac{4}{5} = \frac{?}{10}$; $\quad \frac{1}{2} = \frac{?}{10}$; $\quad \frac{8}{10} - \frac{5}{10} = \frac{?}{10}$

Common denominators

1. Which of these ways of adding $\frac{1}{2}$ and $\frac{1}{3}$ do you like best?

In which is the *smallest common denominator* used?

- $\frac{1}{2} + \frac{1}{3} = \frac{9}{18} + \frac{6}{18} = \frac{15}{18} = \frac{5}{6}$
- $\frac{1}{2} + \frac{1}{3} = \frac{6}{12} + \frac{4}{12} = \frac{10}{12} = \frac{5}{6}$
- $\frac{1}{2} + \frac{1}{3} = \frac{3}{6} + \frac{2}{6} = \frac{5}{6}$

2. In which of Exs. 3–17 can a common denominator be found by using:

- the larger denominator?
- two times the larger denominator?
- three times the larger denominator?

First tell what common denominators you would use in adding or subtracting in these examples. Then work the examples.

3. $\frac{1}{2} + \frac{1}{3}$	4. $\frac{3}{4} - \frac{2}{3}$	5. $\frac{1}{3} - \frac{1}{12}$	6. $\frac{5}{6} + \frac{1}{12}$	7. $\frac{1}{6} + \frac{1}{3}$
8. $\frac{1}{3} - \frac{1}{4}$	9. $\frac{1}{5} + \frac{1}{2}$	10. $\frac{1}{4} - \frac{1}{12}$	11. $\frac{1}{2} - \frac{1}{8}$	12. $\frac{1}{4} + \frac{1}{6}$
13. $\frac{1}{3} - \frac{1}{6}$	14. $\frac{1}{2} - \frac{1}{6}$	15. $\frac{2}{3} - \frac{5}{12}$	16. $\frac{1}{6} + \frac{1}{2}$	17. $\frac{7}{12} - \frac{1}{3}$

To find the smallest common denominator of two fractions, first see whether the larger denominator is the common denominator. If not, try 2 times the larger denominator. If that won't do, try 3 times the larger denominator; and so on.

18. Add. Don't forget to reduce answers to lowest terms.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{2}{3}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{2}{3}$	$\frac{3}{5}$
$\frac{1}{5}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{6}$	$\frac{3}{8}$	$\frac{1}{8}$	$\frac{1}{2}$	$\frac{1}{2}$

19. Subtract the lower fraction from the upper in Ex. 18.

20. Walter has $\frac{2}{3}$ can of red paint. If he uses $\frac{1}{2}$ can to paint a tray, how much will he have left?

21. Jim and Billy were making popcorn. Jim used $\frac{1}{4}$ cup of butter on his popcorn. Billy used $\frac{1}{3}$ cup of butter on his.

Which boy used more butter? How much more?

Adding and subtracting fractions

1. To do the addition $\frac{1}{2} + \frac{2}{3} + \frac{1}{4}$, Tom thinks, "$\frac{6}{12} + \frac{8}{12} + \frac{3}{12} = \frac{17}{12} = 1\frac{5}{12}$." He writes:⟶

$$\begin{array}{r} \frac{1}{2} = \frac{6}{12} \\ \frac{2}{3} = \frac{8}{12} \\ \underline{\frac{1}{4} = \frac{3}{12}} \\ \frac{17}{12} = 1\frac{5}{12} \end{array}$$

Tom has changed all the fractions to twelfths. Do you see what he has done to change the improper fraction $\frac{17}{12}$ to $1\frac{5}{12}$?

2. What does Tom think and write in doing these additions?

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
$\frac{3}{8}$	$\frac{1}{6}$	$\frac{5}{8}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{1}{3}$	$\frac{1}{2}$
$\frac{3}{4}$	$\frac{1}{2}$	$\frac{5}{16}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{5}{12}$	$\frac{3}{4}$	$\frac{5}{12}$
$\frac{1}{2}$	$\frac{5}{12}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{2}{3}$	$\frac{5}{6}$	$\frac{1}{3}$	$\frac{2}{3}$

To find the sum of $2\frac{1}{10}$ and $1\frac{2}{5}$, Tom thinks, "$2\frac{1}{10} + 1\frac{4}{10} = 3\frac{5}{10} = 3\frac{1}{2}$." He writes:⟶

$$\begin{array}{r} 2\frac{1}{10} = 2\frac{1}{10} \\ \underline{1\frac{2}{5} = 1\frac{4}{10}} \\ 3\frac{5}{10} = 3\frac{1}{2} \end{array}$$

3. What does Tom think and write in doing these additions?

a	*b*	*c*	*d*	*e*	*f*	*g*
$5\frac{5}{8}$	$3\frac{1}{6}$	$8\frac{5}{12}$	$2\frac{1}{2}$	$5\frac{1}{6}$	$4\frac{3}{10}$	$5\frac{1}{3}$
$4\frac{1}{8}$	$7\frac{1}{3}$	$9\frac{1}{4}$	$3\frac{1}{6}$	$6\frac{1}{12}$	$9\frac{1}{5}$	$8\frac{5}{12}$

To do the subtraction $3\frac{5}{6} - 1\frac{1}{2}$, Tom thinks, "$3\frac{5}{6} - 1\frac{3}{6} = 2\frac{2}{6} = 2\frac{1}{3}$." He writes:⟶

$$\begin{array}{r} 3\frac{5}{6} = 3\frac{5}{6} \\ \underline{-\ 1\frac{1}{2} = 1\frac{3}{6}} \\ 2\frac{2}{6} = 2\frac{1}{3} \end{array}$$

What do you think and write in doing these subtractions?

	a	*b*	*c*	*d*	*e*	*f*	*g*
4.	$3\frac{5}{6}$	$4\frac{5}{6}$	$2\frac{3}{5}$	$4\frac{5}{12}$	$6\frac{5}{12}$	$4\frac{5}{6}$	$5\frac{1}{2}$
	$1\frac{1}{12}$	$3\frac{1}{2}$	$\frac{1}{10}$	$1\frac{1}{3}$	$2\frac{1}{6}$	$2\frac{2}{3}$	3
5.	$6\frac{11}{12}$	$8\frac{7}{10}$	$3\frac{3}{4}$	$4\frac{7}{16}$	$9\frac{5}{12}$	$8\frac{5}{16}$	$6\frac{7}{8}$
	$\frac{1}{3}$	$2\frac{1}{5}$	$\frac{1}{16}$	$1\frac{1}{4}$	$6\frac{1}{3}$	$5\frac{1}{4}$	$3\frac{1}{2}$

Practice with fractions

1. Joan bought $1\frac{1}{2}$ yd. of gingham to make rag dolls and $1\frac{3}{4}$ yd. for toy cats. In all, Joan bought $1\frac{1}{2}$ yd. + $1\frac{3}{4}$ yd., or __?__ yd.
Tell what she thought as she wrote this addition:→
Draw a diagram to prove that $2\frac{5}{4} = 3\frac{1}{4}$.

$$\begin{array}{r} 1\frac{1}{2} = 1\frac{2}{4} \\ 1\frac{3}{4} = 1\frac{3}{4} \\ \hline 2\frac{5}{4} = 3\frac{1}{4} \end{array}$$

2. In Ex. 1, Joan was adding two mixed numbers; the sum is __?__. Do you think that the sum of two mixed numbers must be a mixed number? Illustrate.

Tell what you think and show what you write in doing these additions:

	a	b	c	d	e	f	g
3.	$2\frac{1}{2}$ $3\frac{5}{8}$	$2\frac{2}{3}$ $1\frac{1}{2}$	$4\frac{2}{3}$ $2\frac{3}{4}$	$2\frac{1}{2}$ $3\frac{3}{4}$	$\frac{3}{4}$ $2\frac{7}{8}$	$3\frac{7}{12}$ $2\frac{1}{2}$	$4\frac{7}{8}$ $2\frac{1}{4}$
4.	$6\frac{5}{8}$ $2\frac{1}{2}$	$3\frac{1}{2}$ $5\frac{2}{3}$	$3\frac{3}{4}$ $2\frac{2}{3}$	$6\frac{3}{4}$ $3\frac{1}{2}$	$3\frac{3}{4}$ $\frac{7}{8}$	$7\frac{1}{2}$ $8\frac{5}{12}$	$3\frac{3}{4}$ $4\frac{7}{8}$

Estimate these sums and differences to the nearest whole number. In the first example think, "$3\frac{7}{8}$ is nearly 4; $5\frac{1}{12}$ is a little more than 5; so the sum is close to 9."

	a	b	c	d	e	f	g
5.	$3\frac{7}{8}$ $+\ 5\frac{1}{12}$	$7\frac{1}{8}$ $+\ 5\frac{1}{4}$	$10\frac{1}{8}$ $+\ 6\frac{3}{4}$	$7\frac{1}{12}$ $+\ 4\frac{7}{8}$	10 $+\ 3\frac{7}{8}$	$8\frac{1}{4}$ $+\ 7\frac{7}{8}$	$12\frac{1}{16}$ $+\ \frac{7}{8}$
6.	$4\frac{7}{8}$ $-\ 1\frac{1}{8}$	$8\frac{5}{6}$ $-\ 3\frac{1}{6}$	$7\frac{3}{4}$ $-\ 6$	$8\frac{11}{12}$ $-\ 4\frac{5}{6}$	$15\frac{7}{8}$ $-\ 8\frac{1}{16}$	$17\frac{11}{16}$ $-\ 6\frac{5}{8}$	$13\frac{3}{4}$ $-\ 4$

7. $3\frac{7}{8} + 5\frac{1}{8} + 2\frac{3}{4} + 6\frac{1}{8} + \frac{15}{16}$

8. $100\frac{7}{8} - 49$

9. $72\frac{1}{10} - 5$

10. Copy and work Exs. 5–9.

Practice with fractions in quotients

1. Mary gets 30 cents an hour for baby sitting. One evening she worked 90 minutes. How many hours did she work? How much did she earn?

How many hours are there in 90 min.? Does this division show there are $1\frac{1}{2}$ hours in 90 min.? Explain.

$$\begin{array}{r} 1\frac{30}{60} = 1\frac{1}{2} \\ 60\overline{)90} \\ \underline{60} \\ 30 \end{array}$$

In the following problems reduce all fractions in the quotients to lowest terms:

2. How many hours are there in 105 min.? 135 min.? 165 min.?

3. How many pounds are there in 40 oz.? 36 oz.? 60 oz.?

4. How many yards are there in 81 in.? 90 in.? 135 in.?

5. How many feet are there in 30 in.? 51 in.? 52 in.?

6. How many days are there in 84 hr.? 102 hr.? 144 hr.?

7. How many dozen are there in 28 things? 39? 54?

8. How many years are there in 40 months? 45? 52?

9. How many weeks are there in 36 days? 44? 50?

10. Last Saturday Mary went baby sitting from 2:30 P.M. to 5:00 P.M. At 30 cents an hour, she earned __?__ cents.

11. At 60 cents a pound, a 20-ounce piece of cheese would cost __?__ cents.

12. At 90 cents a yard, a 90-inch piece of rayon taffeta would cost two dollars and __?__ cents.

13. Sue wants a 45-inch piece of ribbon that sells for 40 cents a yard. It will cost her __?__ cents.

14. Kenneth estimates that he eats 260 eggs a year.

At an average price of 60 cents a dozen, the eggs would cost __?__ dollars.

15. At 60¢ a gallon, find the cost of 10 quarts of cider.

Review practice

1. Tom was staking out a rectangular pen. He wanted the perimeter to be 100 ft. and the 2 long sides each to be 40 ft.

He decided that each of the short sides would have to be ___?___ feet.

2. Mrs. Smith is making sleeping bags for Chuck and Ted to use on their camping trip. Each sleeping bag requires $3\frac{7}{8}$ yd. of material.

Find the cost of the material at $1 a yard.

3. Barbara's grandfather gave her $5 for her birthday. She is going to buy a camera for $3.55 and as many rolls of film at 35¢ as possible with the rest of the money.

Barbara can buy ___?___ rolls of film, and have ___?___ cents left over.

4. For the Community Fair, Ellen made 36 nut bars to sell at 5¢ each. The material cost 69 cents.

If Ellen sells all of the bars, she will take in ___?___ more cents than she spent.

5. $6\frac{5}{6}$ is ___?___ more than $6\frac{1}{2}$.

6. $3\frac{1}{8}$ is ___?___ less than $4\frac{1}{2}$.

7. The sum of $4\frac{2}{3}$, $3\frac{1}{2}$, $\frac{1}{3}$, and $\frac{5}{6}$ is ___?___.

8. Harry wants to save $45 for a bicycle. He has already saved $17.90. He must save ___?___ more.

9. What is the first quotient figure in $28\overline{)5684}$? How can you tell whether the quotient is a one-, two-, or three-figure number?

Estimate the quotient. Then do the division.

10. Sue looked at the division example $56\overline{)2744}$ and said, "The quotient is a little less than 50."

How could she tell that? Find the quotient.

11. Sue was thinking about the multiplication 307×170.

She thought, "100×170 is 17 thousand; so 307×170 is about 3×17 thousand, or ___?___ thousand."

12. How would Sue (Ex. 11) estimate 204×140? 203×150? 406×130?

13. Joe wanted to add $16 + 18 + 20 + 22 + 24$. Quickly he said, "The sum is 5×20, or 100." How could he tell that?

14. If $N - 12 = 8$, then N must be ___?___.

15. If $12 - N = 8$, then N must be ___?___.

Practice with fractions

See if you can do Exs. 1 and 2 without a pencil. Tell what you think as you do each example.

	a	b	c	d	e	f
1.	$\begin{array}{r} \frac{2}{3} \\ \frac{1}{6} \\ +\frac{1}{12} \\ \hline \end{array}$	$\begin{array}{r} \frac{7}{8} \\ \frac{1}{2} \\ +\frac{1}{4} \\ \hline \end{array}$	$\begin{array}{r} \frac{5}{8} \\ \frac{1}{4} \\ +\frac{3}{16} \\ \hline \end{array}$	$\begin{array}{r} \frac{1}{2} \\ \frac{3}{5} \\ +\frac{3}{10} \\ \hline \end{array}$	$\begin{array}{r} \frac{1}{3} \\ \frac{11}{12} \\ +\frac{1}{6} \\ \hline \end{array}$	$\begin{array}{r} \frac{7}{16} \\ \frac{1}{4} \\ +\frac{1}{2} \\ \hline \end{array}$
2.	$\begin{array}{r} \frac{7}{8} \\ -\frac{1}{4} \\ \hline \end{array}$	$\begin{array}{r} \frac{3}{5} \\ -\frac{1}{10} \\ \hline \end{array}$	$\begin{array}{r} \frac{3}{4} \\ -\frac{5}{12} \\ \hline \end{array}$	$\begin{array}{r} \frac{5}{6} \\ -\frac{5}{12} \\ \hline \end{array}$	$\begin{array}{r} \frac{1}{2} \\ -\frac{5}{16} \\ \hline \end{array}$	$\begin{array}{r} \frac{9}{10} \\ -\frac{2}{5} \\ \hline \end{array}$

Can you find any mistakes in Exs. 3–8?

3. $\begin{array}{rcl} 5\frac{1}{2} & = & 5\frac{5}{10} \\ +2\frac{2}{5} & = & 2\frac{4}{10} \\ \hline & & 7\frac{9}{10} \end{array}$

4. $\begin{array}{rcl} 8\frac{2}{3} & = & 8\frac{9}{12} \\ -4\frac{1}{4} & = & 4\frac{3}{12} \\ \hline & & 4\frac{6}{12} = 4\frac{1}{2} \end{array}$

5. $\begin{array}{rcl} 6\frac{3}{4} & = & 6\frac{6}{8} \\ -1\frac{1}{8} & = & 1\frac{1}{8} \\ \hline & & 7\frac{7}{8} \end{array}$

6. $\begin{array}{rcl} 5\frac{3}{8} & = & 5\frac{11}{16} \\ +\frac{3}{16} & = & \frac{3}{16} \\ \hline & & 5\frac{14}{16} = 5\frac{7}{8} \end{array}$

7. $\begin{array}{rcl} 4\frac{1}{6} & = & 4\frac{3}{12} \\ +2\frac{5}{12} & = & 2\frac{5}{12} \\ \hline & & 6\frac{8}{12} = 6\frac{2}{3} \end{array}$

8. $\begin{array}{rcl} 5\frac{1}{2} & = & 5\frac{5}{10} \\ -2\frac{3}{10} & = & 2\frac{3}{10} \\ \hline & & 3\frac{2}{10} = 3\frac{1}{5} \end{array}$

Estimate these sums and differences to the nearest whole number. Then copy and work.

	a	b	c	d	e	f
9.	$\begin{array}{r} 6\frac{3}{4} \\ +7\frac{5}{8} \\ \hline \end{array}$	$\begin{array}{r} 7\frac{5}{6} \\ +3\frac{7}{12} \\ \hline \end{array}$	$\begin{array}{r} 2\frac{5}{12} \\ +2\frac{1}{4} \\ \hline \end{array}$	$\begin{array}{r} 3\frac{1}{10} \\ +2\frac{1}{2} \\ \hline \end{array}$	$\begin{array}{r} 4\frac{1}{2} \\ +2\frac{3}{5} \\ \hline \end{array}$	$\begin{array}{r} 2\frac{1}{4} \\ +2\frac{2}{3} \\ \hline \end{array}$
10.	$\begin{array}{r} 4\frac{1}{4} \\ -1\frac{1}{12} \\ \hline \end{array}$	$\begin{array}{r} 2\frac{7}{10} \\ -\frac{1}{2} \\ \hline \end{array}$	$\begin{array}{r} 6\frac{3}{4} \\ -3\frac{1}{8} \\ \hline \end{array}$	$\begin{array}{r} 5\frac{5}{8} \\ -\frac{3}{16} \\ \hline \end{array}$	$\begin{array}{r} 4\frac{4}{5} \\ -1\frac{7}{10} \\ \hline \end{array}$	$\begin{array}{r} 3\frac{2}{3} \\ -\frac{1}{6} \\ \hline \end{array}$
11.	$\begin{array}{r} 5\frac{7}{8} \\ -2\frac{1}{2} \\ \hline \end{array}$	$\begin{array}{r} 7\frac{5}{12} \\ -3\frac{1}{3} \\ \hline \end{array}$	$\begin{array}{r} 9\frac{1}{2} \\ -7 \\ \hline \end{array}$	$\begin{array}{r} 7\frac{9}{10} \\ -2\frac{1}{5} \\ \hline \end{array}$	$\begin{array}{r} 8\frac{11}{12} \\ -\frac{3}{4} \\ \hline \end{array}$	$\begin{array}{r} 11\frac{9}{16} \\ -7\frac{1}{4} \\ \hline \end{array}$

Arithmetic roundup

▶ Oral review

Can you find any mistakes in Exs. 1–15?

1. $$\begin{array}{r} 4\frac{2}{3} = 4\frac{8}{12} \\ +\ 3\frac{1}{4} = 3\frac{3}{12} \\ \hline 7\frac{11}{12} \end{array}$$

2. $$\begin{array}{r} 5\frac{5}{6} = 5\frac{10}{12} \\ +\ 3\frac{1}{12} = 3\frac{1}{12} \\ \hline 8\frac{11}{12} \end{array}$$

3. $$\begin{array}{r} 4\frac{2}{3} = 4\frac{4}{6} \\ +\ 5\frac{1}{2} = 5\frac{3}{6} \\ \hline 9\frac{7}{6} \end{array}$$

4. $$\begin{array}{r} 3\frac{5}{6} = 3\frac{10}{12} \\ +\ 2\frac{3}{4} = 2\frac{9}{12} \\ \hline 5\frac{19}{12} = 6\frac{7}{12} \end{array}$$

5. $$\begin{array}{r} 4\frac{2}{3} = 4\frac{4}{6} \\ +\ 1\frac{1}{6} = 1\frac{1}{6} \\ \hline 5\frac{5}{6} \end{array}$$

6. $$\begin{array}{r} 5\frac{3}{4} = 5\frac{15}{20} \\ +\ 2\frac{3}{5} = 2\frac{12}{20} \\ \hline 7\frac{27}{20} = 8\frac{7}{20} \end{array}$$

7. $1\frac{1}{4}$ lb. = 20 oz.
8. $1\frac{1}{3}$ yd. = 45 in.
9. 9 mo. = $\frac{3}{4}$ yr.
10. $1\frac{1}{4}$ gal. = 6 qt.
11. 27 in. = $\frac{2}{3}$ yd.
12. 24 qt. = 3 pk.
13. $1\frac{1}{4}$ hr. = 90 min.
14. 12 oz. = $\frac{3}{4}$ lb.
15. 12 pk. = 3 bu.

▶ Written review

1. $$\begin{array}{r} 58679 \\ -\ 49876 \\ \hline \end{array}$$

2. $$\begin{array}{r} 409 \\ \times\ 608 \\ \hline \end{array}$$

3. $$\begin{array}{r} 456 \\ \times\ 2800 \\ \hline \end{array}$$

4. $$\begin{array}{r} \$469.80 \\ 27.54 \\ 308.00 \\ 79.46 \\ 82.93 \\ \hline \end{array}$$

5. $$\begin{array}{r} 658 \\ 204 \\ 470 \\ 658 \\ 473 \\ \hline \end{array}$$

6. $95\overline{)4370}$
7. $46\overline{)1610}$
8. $45\overline{)12035}$

9. A train traveled from New York to Chicago, a distance of 912 miles, in 16 hours.

The train averaged _?_ miles an hour.

10. Barbara needs 45 inches of gingham to make a laundry bag for camp. She also needs a 10-cent roll of tape for the strings.

If she pays 60¢ a yard for gingham, how much will the bag cost?

11. Chuck helped his father box 500 tomato plants. They put 25 plants in each box and sold them for $2 a box.

How much should they get for the 500 tomato plants?

12. Miss Green's pupils want to buy a 50-dollar radio. They now have $34.67.

How much more must they earn?

Improper fractions and mixed numbers

Kate, Julia, and Pamela each found the sum of $\frac{5}{8} + \frac{3}{4} + \frac{3}{8}$.

Kate said the sum was $\frac{14}{8}$.

Julia said the sum was $1\frac{6}{8}$.

Pamela said the sum was $1\frac{3}{4}$.

Which girl gave the best answer? the poorest? Why do you think so?

$$\begin{array}{r} \frac{5}{8} = \frac{5}{8} \\ \frac{3}{4} = \frac{6}{8} \\ \underline{\frac{3}{8} = \frac{3}{8}} \\ \frac{14}{8} = 1\frac{6}{8} = 1\frac{3}{4} \end{array}$$

Change these improper fractions to mixed numbers and reduce fractions to lowest terms. In Ex. 1 draw diagrams to prove your answers.

	a	b	c	d	e	f	g	h
1.	$\frac{9}{6}$	$\frac{12}{8}$	$\frac{14}{6}$	$\frac{18}{8}$	$\frac{19}{6}$	$\frac{22}{3}$	$\frac{21}{6}$	$\frac{20}{8}$
2.	$\frac{14}{4}$	$\frac{18}{4}$	$\frac{21}{9}$	$\frac{28}{8}$	$\frac{27}{6}$	$\frac{30}{9}$	$\frac{33}{6}$	$\frac{39}{9}$
3.	$\frac{22}{4}$	$\frac{34}{8}$	$\frac{38}{6}$	$\frac{15}{4}$	$\frac{14}{10}$	$\frac{18}{10}$	$\frac{36}{8}$	$\frac{22}{6}$

4. Explain each step:

$$\begin{array}{rcl} 4\frac{3}{4} & = & 4\frac{9}{12} \\ +\ 2\frac{5}{12} & = & 2\frac{5}{12} \\ \hline & & 6\frac{14}{12} = 7\frac{2}{12} = 7\frac{1}{6} \end{array}$$

Do these additions. Be sure each answer is in the best form.

	a	b	c	d	e	f	g	h
5.	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{10}$	$\frac{1}{4}$	$4\frac{5}{6}$	$2\frac{3}{4}$	$2\frac{1}{2}$
	$\frac{5}{12}$	$\frac{7}{12}$	$\frac{3}{16}$	$\frac{1}{2}$	$\frac{2}{3}$	$3\frac{2}{3}$	$6\frac{7}{12}$	4
	$\frac{1}{4}$	$\frac{5}{6}$	$\frac{1}{2}$	$\frac{3}{5}$	$\frac{5}{12}$	$2\frac{1}{2}$	3	$1\frac{3}{5}$
6.	$3\frac{1}{12}$	$6\frac{3}{4}$	$7\frac{11}{16}$	$4\frac{5}{6}$	$8\frac{1}{2}$	$2\frac{1}{3}$	$8\frac{3}{16}$	$4\frac{1}{2}$
	$2\frac{1}{3}$	$\frac{1}{12}$	$5\frac{1}{2}$	$\frac{1}{12}$	$\frac{1}{6}$	$\frac{5}{12}$	$7\frac{3}{4}$	$9\frac{5}{16}$
	$5\frac{1}{6}$	$4\frac{1}{2}$	$3\frac{5}{16}$	$5\frac{1}{12}$	$4\frac{1}{12}$	$1\frac{3}{4}$	$\frac{5}{8}$	$2\frac{3}{8}$

Common denominators

What common denominator should you use to add:

1. halves and thirds?
2. thirds and fourths?
3. halves and tenths?
4. fifths and tenths?
5. sixths and twelfths?
6. halves and fourths?
7. halves, thirds, and fourths?
8. halves, fifths, and tenths?
9. halves, thirds, fourths, and sixths?
10. halves, thirds, fourths, and eighths?
11. fourths, eighths, and sixteenths?
12. halves, fourths, and twelfths?

What common denominator should you use to subtract:

13. thirds from halves?
14. eighths from halves?
15. eighths from sixths?
16. tenths from fifths?
17. fourths from thirds?
18. sixths from fourths?
19. eighths from fourths?
20. tenths from halves?
21. fifths from fourths?
22. fourths from halves?
23. fifths from halves?
24. eighths from sixteenths?

Try to do these additions and subtractions mentally. Then check by doing them as written work.

	a	b	c	d	e
25.	$\frac{3}{5} + \frac{3}{10}$	$2\frac{1}{2} - \frac{1}{4}$	$3\frac{3}{4} + 2\frac{1}{2}$	$\frac{5}{8} - \frac{1}{2}$	$\frac{5}{8} - \frac{5}{16}$
26.	$\frac{3}{5} - \frac{3}{10}$	$2\frac{2}{3} - 1\frac{1}{4}$	$3\frac{3}{4} - 2\frac{1}{2}$	$\frac{7}{8} + \frac{3}{4}$	$1\frac{3}{4} + 1\frac{5}{16}$
27.	$\frac{5}{8} + \frac{1}{2}$	$\frac{11}{16} + \frac{1}{2}$	$2\frac{2}{3} + 1\frac{1}{4}$	$\frac{7}{8} - \frac{3}{4}$	$\frac{13}{16} - \frac{5}{8}$
28.	$\frac{5}{6} - \frac{5}{12}$	$4\frac{15}{16} + 1\frac{1}{8}$	$5\frac{7}{8} + 4\frac{1}{6}$	$\frac{7}{8} + \frac{1}{2}$	$3\frac{5}{8} - 2\frac{1}{4}$

Review exercises

SET I

	a	b	c	d	e	f
1.	$\frac{1}{2} = \frac{?}{10}$	$\frac{2}{3} = \frac{?}{6}$	$\frac{3}{5} = \frac{?}{10}$	$\frac{5}{8} = \frac{?}{16}$	$\frac{2}{3} = \frac{?}{15}$	$\frac{5}{6} = \frac{?}{12}$

Change these to the best form for answers:

	a	b	c	d	e	f	g	h
2.	$\frac{6}{18}$	$\frac{5}{15}$	$\frac{5}{10}$	$\frac{12}{16}$	$\frac{8}{10}$	$\frac{6}{9}$	$\frac{11}{4}$	$\frac{15}{4}$
3.	$\frac{18}{4}$	$\frac{15}{10}$	$\frac{27}{6}$	$\frac{26}{8}$	$\frac{30}{12}$	$\frac{24}{12}$	$\frac{19}{3}$	$\frac{19}{6}$

SET II

	a	b	c	d	e
1.	$\frac{1}{4} + \frac{1}{6}$	$\frac{1}{4} + \frac{2}{3}$	$\frac{1}{3} - \frac{1}{6}$	$\frac{3}{4} - \frac{2}{3}$	$\frac{7}{8} - \frac{3}{4}$
2.	$\frac{3}{10} + \frac{1}{2}$	$\frac{4}{5} - \frac{1}{2}$	$\frac{3}{4} - \frac{1}{3}$	$\frac{3}{4} + \frac{1}{3}$	$\frac{5}{6} + \frac{1}{4}$

SET III

	a	b	c	d	e	f	g	h
1.	$\frac{1}{4}$	$\frac{1}{12}$	$\frac{3}{16}$	$\frac{9}{10}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{3}{4}$	$\frac{3}{4}$
	$\frac{1}{8}$	$\frac{1}{3}$	$\frac{3}{8}$	$\frac{2}{5}$	$\frac{3}{4}$	$\frac{1}{8}$	$\frac{3}{4}$	$\frac{1}{3}$
	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{2}{3}$

2. Add: $\frac{2}{3}$, $\frac{1}{6}$, and $\frac{11}{12}$.

3. Find $\frac{7}{16}$ more than $\frac{7}{8}$.

SET IV

	a	b	c	d	e	f	g
1.	$\frac{5}{6}$	$\frac{9}{16}$	$\frac{7}{10}$	$\frac{7}{12}$	$\frac{5}{6}$	$9\frac{3}{5}$	$8\frac{3}{4}$
	$-\frac{1}{3}$	$-\frac{3}{8}$	$-\frac{1}{2}$	$-\frac{1}{3}$	$-\frac{1}{4}$	$-2\frac{1}{2}$	$-2\frac{1}{3}$

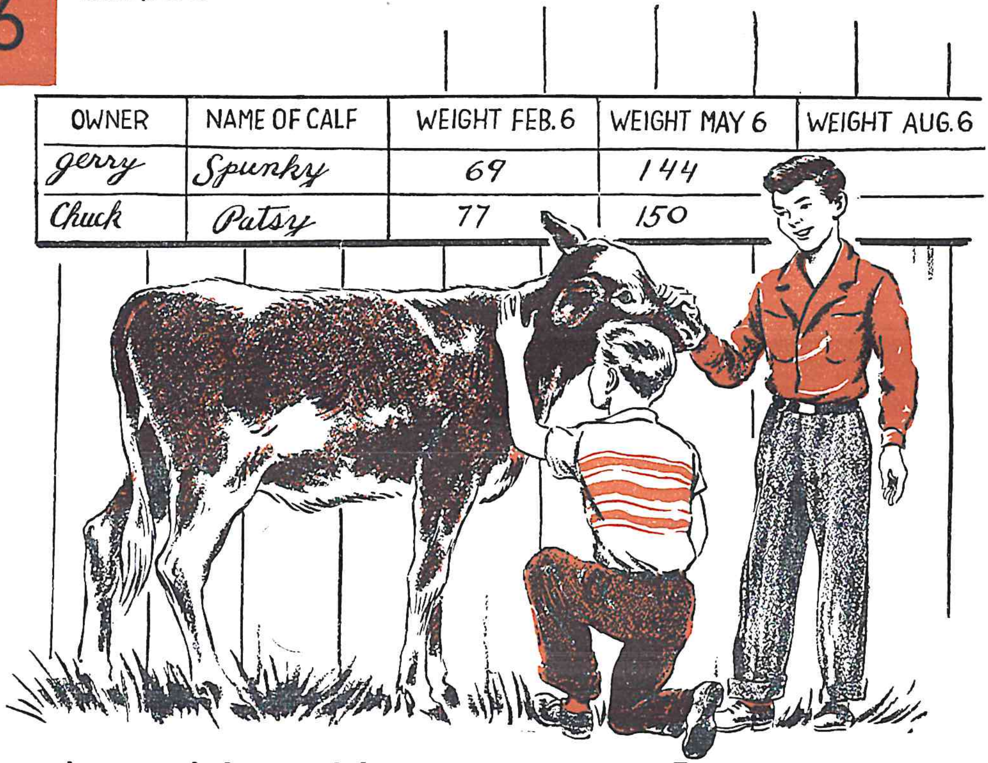
2. $6\frac{5}{6}$ less $3\frac{1}{3}$ = _?_.

3. The difference between $5\frac{5}{6}$ and $2\frac{1}{2}$ is _?_.

4. $2\frac{1}{2}$ from $8\frac{3}{4}$ = _?_.

5. $3\frac{5}{6}$ is how much more than $2\frac{1}{3}$?

OWNER	NAME OF CALF	WEIGHT FEB. 6	WEIGHT MAY 6	WEIGHT AUG. 6
Jerry	Spunky	69	144	
Chuck	Patsy	77	150	



Solving club problems

Do you belong to American Junior Red Cross, to a Cub Pack, to a 4-H Club, or to any other club or organization? If so, tell the class about ways your group uses arithmetic.

Below are some club problems of other boys and girls.

1. Chuck and Jerry are raising twin calves in a 4-H Club project. Jerry's calf weighed 69 lb. at birth; Chuck's calf weighed 77 lb.

The picture shows how much their calves weighed on May 6. Whose calf had gained more, Chuck's or Jerry's?

2. Christopher also belongs to a 4-H Club. One of his sheep weighed $170\frac{3}{4}$ lb. before its wool was sheared and $161\frac{3}{8}$ lb. after shearing.

Do you know how much the fleece weighed?

3. Elizabeth is knitting squares for a blanket for Junior Red Cross. To earn money to buy yarn for the squares, Elizabeth cared for a neighbor's baby 8 evenings this month. She earned 90¢ an evening.

How many balls of yarn at 39¢ each can she buy?

4. Jane also is knitting for Junior Red Cross. She is planning to buy 8 ounces of yarn. She can buy four 2-oz. balls for 29¢ each or two 4-oz. balls at 54¢ each.

Which would you buy? Why?

5. Mary Ellen belongs to the Camp Fire Girls. For her homecraft activity, she made 7 glasses of marmalade.

She bought $\frac{1}{2}$ doz. oranges at 60¢ a dozen and 5 lb. sugar at 9¢ a pound. How much did these materials cost?

6. One law of the Camp Fire Girls is "Hold On to Health." The girls check items of health each day.

If Claire goes to bed at 8:30 P.M. and gets up at 7:00 A.M., how many hours has she been in bed?

7. The girls in Hilda's Brownie troop are going to have a picnic 10 miles from town. They will go $6\frac{1}{2}$ mi. by bus, $2\frac{1}{4}$ mi. by truck, and walk the rest of the way.

Hilda figures she will walk $2\frac{1}{2}$ miles. How does she figure that?

8. Banks lend large sums of money each year to help 4-H Club members raise livestock and crops.

A club of 16-year-old boys borrowed $150 and raised livestock worth $450. Do you think the $300 difference was all gain?

9. A full Boy Scout troop consists of 4 patrols of 8 boys each, or _?_ boys all together.

10. A boy must be 11 years old to become a Boy Scout. Frank is 9 yr. 8 mo. old. How long must he wait to become a Scout?

11. The regular subscription price to *Boys' Life,* the Scout magazine, is $2.00 a year. If 5 boys subscribe at one time, a special subscription price of $1.50 each is made.

How much will Dave save if he subscribes with a group of 4 other boys? How much will the group save?

12. The girls in one Girl Scout troop planted forget-me-not plants in pots for hospital patients.

The girls bought 5 trays of plants at 80¢ a tray, 5 doz. flowerpots at 5¢ each, and 5 doz. saucers at 5¢ each. They spent _?_.

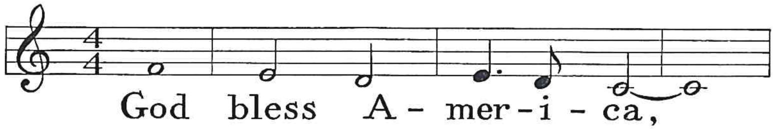
13. A girls' club held a Spring Market Day one Saturday to raise funds for their day camp.

They took in these amounts: door, $3.15; cooky table, $2.48; candy booth, $3.60; flower bench, $4.85; toy counter, $4.20; balloons, $3.10.

How much did they take in all together?

Fractions in music

Following the flag salute, the children in Jeff's class sang "God Bless America." Do you know how fractions are used in this song and in other music, too?



𝅝 is a whole note. ♩ is a quarter note.

𝅗𝅥 is a half note. ♪ is an eighth note.

𝅘𝅥𝅯 is a sixteenth note.

A whole $= 1 = \frac{?}{2} = \frac{?}{4} = \frac{?}{8} = \frac{?}{16}$.

A whole note = 𝅝 = 𝅗𝅥𝅗𝅥 = ♩♩♩♩ = ♪♪♪♪♪♪♪♪ = ? 𝅘𝅥𝅯's

1. A half note = ? quarter notes = ? eighth notes = ? sixteenth notes.

2. A quarter note = ? eighth notes = ? sixteenth notes.

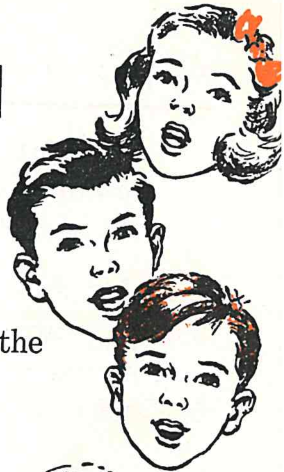
3. An eighth note = ? sixteenth notes.

4. A dot after a note adds to the note one half of its value. A dot after a *quarter note* adds $\frac{1}{2}$ of $\frac{1}{4}$, or ?, to its value. A dotted quarter note equals a quarter note and an eighth note, or ? eighth notes. Does ♩. = ♩♪ = ♪♪♪ ?

5. In the music for "God Bless America," find 2 whole notes; 3 half notes; a dotted quarter note; an eighth note.

6. The $\frac{4}{4}$ shows that the song above is written in $\frac{4}{4}$ *time.* The *lower* 4 shows that every quarter note should have one *beat* or *count.* The *top* 4 shows that there are four beats or counts in a *measure.*

Is the value of all the notes in each measure equal to four quarter notes?



7. "America" is written in $\frac{3}{4}$ time. In $\frac{3}{4}$ time it takes three quarter notes, or any group of notes equal to three quarter notes, to fill a measure.

Show that the value of all the notes in each measure of the music above is equal to three quarter notes.

In the second measure 𝅘𝅥. $= \frac{1}{4} + \frac{1}{8} = \frac{?}{8}$.

8. This song is in $\frac{6}{8}$ time. How many eighth notes does it take to fill a measure?

How many quarter notes does it take to have the same value as six eighth notes? $\frac{6}{8} = \frac{?}{4}$.

Show that the value of the notes in each measure above is equal to six eighth notes.

9. A half note and two quarter notes are given as much time as how many quarter notes? $(\frac{1}{2} + \frac{2}{4} = \frac{?}{4}.)$

10. Two quarter notes and four eighth notes take as much time as how many half notes? $(\frac{2}{4} + \frac{4}{8} = \frac{?}{2}.)$

11. Will a dotted quarter and four eighth notes fill a measure in $\frac{4}{4}$ time?

12. How many eighth notes should you add to a dotted quarter note in $\frac{3}{4}$ time to fill the measure?

13. How many eighth notes should you add to a dotted quarter note in $\frac{4}{4}$ time to fill the measure?

14. Do you take music lessons? If so, tell the class how you learned to understand the value of notes.

A quiz show

James heard a children's quiz show on the radio. One boy was asked these questions and answered them all correctly. He won a bicycle. Could you have won the bicycle?

1. Mr. and Mrs. Field and their 3 children are going to the movies.

How much will two tickets at 50¢ and three at 35¢ cost?

2. John sold 45 magazines at 20¢ each and collected $4.60 from his newspaper customers.

How much did he take in?

3. Bob kept a library book 23 days. The fine is 2¢ a day for each day over 2 weeks.

How large a fine did Bob have to pay?

4. The passengers from a wrecked airplane were on rubber rafts in the water for 96 hours before they were rescued.

How many days and nights were they on the rafts?

5. If it takes 30 min. per pound to roast pork, how long will it take to roast a 5-pound loin of pork?

When should your mother put the roast in the oven to have it ready to eat at noon?

Some oral practice

1. If you multiply \$.44 by 200, the answer is ___?___.

2. When you are numbering cards, the one following 1099 is numbered ___?___.

3. From 8:15 A.M. to 8:52 A.M. is ___?___ min.

4. At 20¢ a pound, 12 oz. of birdseed will cost ___?___¢.

5. An 18-oz. can of tomatoes weighs ___?___ lb.

6. If a grocer divides a 10-lb. bag of sugar into 8-oz. packages, there will be ___?___ packages.

7. The difference between a line $2\frac{1}{4}$ yd. long and a line 80 in. long is ___?___ in.

8. At 3 for 10¢, 9 lemons will cost ___?___¢.

9. What is the change from \$10 if your bill is \$7.89?

10. What is:
$\frac{1}{5}$ of \$10.50? $\frac{3}{4}$ of \$1.20? $\frac{2}{3}$ of 96¢?

11. Find the perimeter of a rectangle $5' \times 24''$.

12. Compare 4 ft. with 6 ft. by subtraction; by division.

Some written practice

Work each example. Then estimate to see if your answer is sensible.

1. Add \$252.80, \$98, \$5.78, \$18.06, and \$.87.

2. \$100 − \$62.50

3. From \$20 take \$15.75.

4. Multiply \$8.29 by 8.

5. $28 \times \$17.69$

6. $7\overline{)\$49.35}$

7. $6\overline{)\$35.40}$

8. $26\overline{)5278}$

9. $24818 \div 62$

10. $\frac{7}{12} + \frac{3}{4}$

11. $14\frac{5}{6} + 5\frac{1}{4}$

12. $15\frac{4}{5} - 5\frac{1}{2}$

13. $10\frac{7}{8} - 6\frac{5}{16}$

14. $\frac{5}{8} + \frac{1}{2}$

15. $3\frac{3}{4} + 12\frac{1}{3}$

16. $15\frac{7}{8} - 2\frac{1}{4}$

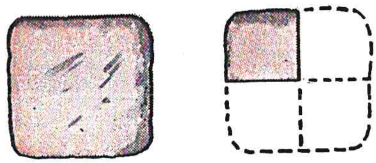
17. $12\frac{1}{2} - 3\frac{1}{4}$

UNIT 27

Borrowing in subtraction of fractions and mixed numbers. Problem solving. Maintenance.

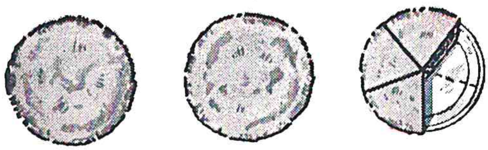
Fractions from whole numbers

1. How much of 2 cakes is left after $\frac{3}{4}$ of a cake is eaten? Use the picture below to help you tell what you have to do before you can subtract $\frac{3}{4}$ from 2.



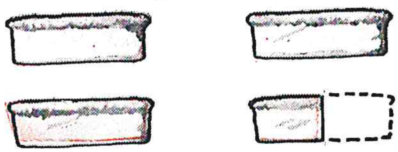
To subtract $\frac{3}{4}$ from 2, you think of 2 as $1\frac{4}{4}$. $1\frac{4}{4} - \frac{3}{4} = \underline{\ ?\ }$.

2. How much pie is left from 3 pies after $\frac{2}{5}$ of a pie is eaten?



To subtract $\frac{2}{5}$ from 3, think of 3 as $2\frac{5}{5}$. $2\frac{5}{5} - \frac{2}{5} = 2\frac{?}{5}$.

3. How much cake is left from 4 cakes after $\frac{1}{2}$ of a cake is eaten?



To subtract $\frac{1}{2}$ from 4, think of 4 as $\underline{\ ?\ }$. $3\frac{2}{2} - \frac{1}{2} = \underline{\ ?\ }$. $4 - \frac{1}{2} = \underline{\ ?\ }$.

4. $2 = 1\frac{?}{5}$ $\quad 2 = 1\frac{?}{3}$ $\quad 2 = 1\frac{?}{8}$

5. Draw diagrams to show how to subtract each fraction from 2:

$\frac{3}{5}$ $\quad \frac{2}{3}$ $\quad \frac{3}{4}$ $\quad \frac{7}{8}$ $\quad \frac{5}{6}$ $\quad \frac{2}{5}$ $\quad \frac{7}{10}$

6. Subtract each fraction in Ex. 5 from 3; from 5; from 6; from 10.

7. If you cut $\frac{3}{4}$ yard of gingham from a 5-yard piece, how many yards of gingham will you have left?

8. Jean had 4 cookies. She has eaten all but $\frac{1}{2}$ of a cooky. How many has she eaten?

9. Albert is in school for 3 hours each morning. A quarter hour of that time is playtime.

How many hours of work time does Albert have during the morning?

10. Jane bought 3 cartons of margarine. Each carton holds 1 lb. of margarine in quarter-pound sticks.

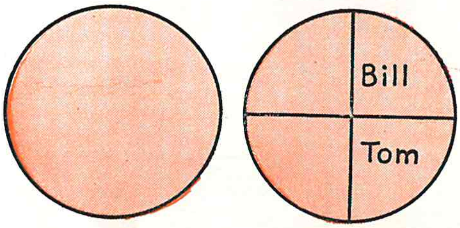
Jane used two of the quarter-pound sticks in a cake. How much margarine was left?

11. Use quarters (toy money) to show that 6 dollars less 3 quarters is $5\frac{1}{4}$ dollars.

12. Patricia bought a 5-pound bag of sugar. She used $\frac{1}{2}$ pound of it to sweeten some apple sauce. How much sugar was left in the bag?

Mixed numbers in subtraction

Peter's mother had $2\frac{1}{4}$ pies. She gave Peter, Tom, and Bill each $\frac{1}{4}$ of a pie. Can you tell, without reading on, how much pie was left?



First she gave Peter $\frac{1}{4}$ of a pie. Then she cut into one of her whole pies to get pieces for Tom and Bill.

Show on the drawing the $\frac{1}{4}$ pie she served to Peter. Show the $\frac{2}{4}$ pie she gave to Tom and Bill.

Did she have 1 whole pie and $\frac{2}{4}$ pie left? Does $1\frac{2}{4} = 1\frac{1}{2}$?
Does $2\frac{1}{4} - \frac{3}{4} = 1\frac{1}{2}$?

This is the way to subtract $\frac{3}{4}$ from $2\frac{1}{4}$: ⟶ First write $\frac{3}{4}$ under $2\frac{1}{4}$. Notice that you cannot subtract $\frac{3}{4}$ from $\frac{1}{4}$. You know that 2 wholes equal $1\frac{4}{4}$; so $2\frac{1}{4} = 1\frac{4}{4} + \frac{1}{4} = 1\frac{5}{4}$.

$$\begin{array}{rcr} 2\frac{1}{4} & = & 1\frac{5}{4} \\ -\frac{3}{4} & = & \frac{3}{4} \\ \hline & & 1\frac{2}{4} = 1\frac{1}{2} \end{array}$$

Explain how the subtraction in the box tells the story of Peter's mother's pies.

1. Draw diagrams to show that: $3\frac{1}{2} = 2\frac{3}{2}$ $\quad 4\frac{1}{3} = 3\frac{4}{3}$ $\quad 2\frac{2}{5} = 1\frac{7}{5}$

2. Explain these subtraction examples. Then copy the examples without the work and see if you can do them. Can you make a rule for this kind of subtraction?

$$\begin{array}{rcr} 2\frac{1}{6} & = & 1\frac{7}{6} \\ -\frac{5}{6} & = & \frac{5}{6} \\ \hline & & 1\frac{2}{6} = 1\frac{1}{3} \end{array} \qquad \begin{array}{rcr} 3 & = & 2\frac{8}{8} \\ -\frac{5}{8} & = & \frac{5}{8} \\ \hline & & 2\frac{3}{8} \end{array} \qquad \begin{array}{rcr} 4 & = & 3\frac{9}{9} \\ -1\frac{5}{9} & = & 1\frac{5}{9} \\ \hline & & 2\frac{4}{9} \end{array} \qquad \begin{array}{rcr} 5\frac{3}{8} & = & 4\frac{11}{8} \\ -\frac{7}{8} & = & \frac{7}{8} \\ \hline & & 4\frac{4}{8} = 4\frac{1}{2} \end{array}$$

	a	*b*	*c*	*d*	*e*
3.	$3\frac{1}{4} - \frac{3}{4}$	$6 - \frac{1}{5}$	$5\frac{1}{3} - \frac{2}{3}$	$7\frac{1}{8} - \frac{3}{8}$	$2\frac{1}{12} - \frac{5}{12}$
4.	$4\frac{1}{5} - \frac{4}{5}$	$8 - 2\frac{3}{4}$	$4\frac{5}{8} - \frac{7}{8}$	$1\frac{1}{8} - \frac{3}{8}$	$3\frac{3}{16} - \frac{9}{16}$
5.	$5\frac{1}{4} - \frac{3}{4}$	$8 - 4\frac{1}{8}$	$6\frac{1}{4} - \frac{3}{4}$	$6\frac{1}{3} - \frac{2}{3}$	$8\frac{1}{10} - \frac{3}{10}$

A fraction from a mixed number

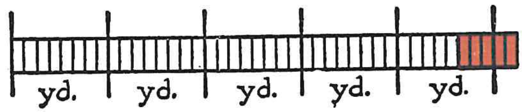
The boys on Maple Street are fixing up their tree house. They found a $5\frac{1}{4}$-yard piece of waterproof canvas. If Bruce uses a $\frac{5}{8}$-yard piece to cover their treasure chest, how much will they have left?

To find out, Bruce subtracted $\frac{5}{8}$ from $5\frac{1}{4}$: ⟶

$$\begin{array}{rcccr} 5\frac{1}{4} & = & 5\frac{2}{8} & = & 4\frac{10}{8} \\ -\frac{5}{8} & = & \frac{5}{8} & = & \frac{5}{8} \\ \hline & & & & 4\frac{5}{8} \end{array}$$

He changed $\frac{1}{4}$ to $\frac{2}{8}$, so that he could subtract eighths from eighths. Then he changed $5\frac{2}{8}$ to $4\frac{10}{8}$. Why?

How does the diagram below explain the subtraction in the box?



1. Explain these subtraction examples. Then copy them without the work and see if you can do them.

$$\begin{array}{rcccr} 5\frac{1}{2} & = & 5\frac{2}{4} & = & 4\frac{6}{4} \\ -\frac{3}{4} & = & \frac{3}{4} & = & \frac{3}{4} \\ \hline & & & & 4\frac{3}{4} \end{array}$$

$$\begin{array}{rcccr} 4\frac{1}{6} & = & 4\frac{1}{6} & = & 3\frac{7}{6} \\ -\frac{2}{3} & = & \frac{4}{6} & = & \frac{4}{6} \\ \hline & & & & 3\frac{3}{6} = 3\frac{1}{2} \end{array}$$

$$\begin{array}{rcccr} 2\frac{1}{3} & = & 2\frac{4}{12} & = & 1\frac{16}{12} \\ -\frac{3}{4} & = & \frac{9}{12} & = & \frac{9}{12} \\ \hline & & & & 1\frac{7}{12} \end{array}$$

2. $\begin{array}{r} 8\frac{1}{2} \\ -\frac{3}{4} \\ \hline \end{array}$ **3.** $\begin{array}{r} 5\frac{1}{6} \\ -\frac{1}{3} \\ \hline \end{array}$ **4.** $\begin{array}{r} 3\frac{1}{4} \\ -\frac{3}{8} \\ \hline \end{array}$ **5.** $\begin{array}{r} 4\frac{3}{8} \\ -\frac{1}{2} \\ \hline \end{array}$ **6.** $\begin{array}{r} 7\frac{1}{2} \\ -\frac{2}{3} \\ \hline \end{array}$ **7.** $\begin{array}{r} 5\frac{1}{4} \\ -\frac{1}{3} \\ \hline \end{array}$

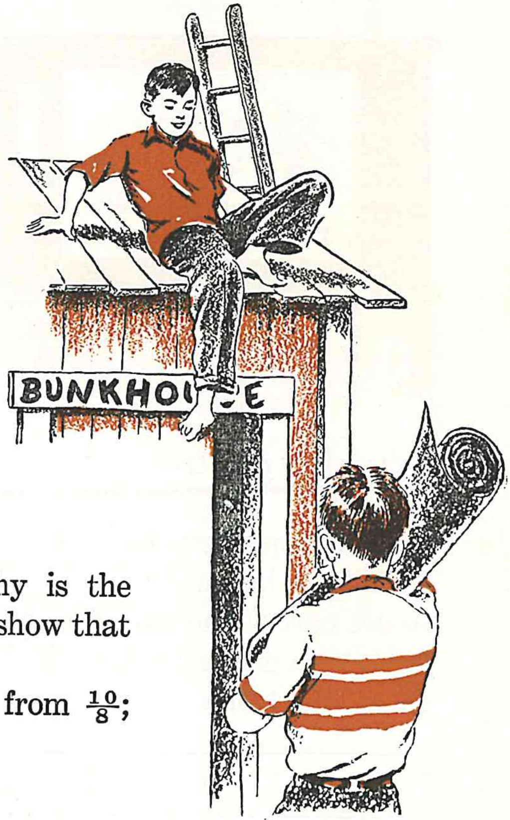
8. How much oilcloth would be left from the $4\frac{5}{8}$-yd. piece if Bruce used $\frac{7}{8}$ yd. for a table cover?

9. Walter has a strip of linoleum $3\frac{3}{8}$ yd. long. How much will be left if he uses $\frac{3}{4}$ yd.?

10. The boys in Richard's Cub Pack bought 4 quarts of milk for a campfire supper.

If they use a quart and a half of the milk in their tomato soup, how much milk will they have left to drink?

Mixed numbers in subtraction



Some boys had a piece of roofing paper $5\frac{1}{4}$ yd. long. They used part of it to patch the roof of their bunkhouse. They have $2\frac{7}{8}$ yd. left.

They wonder how much they used. What should they do to find out?

Can you subtract $2\frac{7}{8}$ from $5\frac{1}{4}$? Try it before you read further.

This is the way to do it:

$$\begin{array}{r} 5\frac{1}{4} = 5\frac{2}{8} = 4\frac{10}{8} \\ -\ 2\frac{7}{8} = 2\frac{7}{8} = 2\frac{7}{8} \\ \hline 2\frac{3}{8} \end{array}$$

Why is the $5\frac{1}{4}$ changed to $5\frac{2}{8}$? Why is the $5\frac{2}{8}$ changed to $4\frac{10}{8}$? Draw a diagram to show that $5\frac{1}{4} = 4\frac{10}{8}$.

To subtract $2\frac{7}{8}$ from $4\frac{10}{8}$, subtract $\frac{7}{8}$ from $\frac{10}{8}$; then subtract 2 from 4.

Subtract:

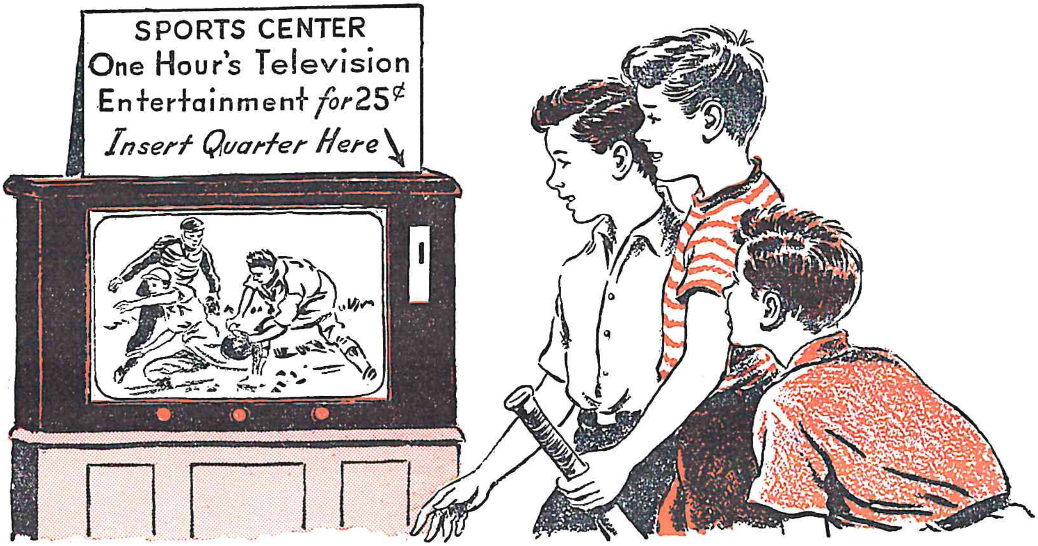
	a	b	c	d	e
1.	$12\frac{1}{6} - 2\frac{5}{6}$	$5\frac{1}{4} - 2\frac{2}{3}$	$3\frac{1}{6} - \frac{2}{3}$	$7\frac{1}{4} - 1\frac{2}{3}$	$8\frac{1}{4} - 5\frac{3}{4}$
2.	$12\frac{1}{4} - 11\frac{1}{2}$	$6\frac{1}{4} - 2\frac{5}{8}$	$10 - \frac{3}{8}$	$4\frac{2}{3} - 1\frac{5}{6}$	$5\frac{1}{2} - \frac{2}{3}$
3.	$13\frac{3}{8} - 10\frac{5}{8}$	$7\frac{5}{16} - \frac{9}{16}$	$9\frac{1}{2} - 4$	$7 - \frac{5}{16}$	$14\frac{1}{2} - \frac{7}{8}$
4.	$12\frac{1}{2} - 6\frac{3}{4}$	$3\frac{3}{4} - 1\frac{5}{8}$	$9 - 2\frac{7}{8}$	$2\frac{1}{8} - 1\frac{1}{4}$	$4 - 1\frac{5}{6}$

5. From a piece of cloth $7\frac{1}{4}$ ft. long the boys cut off $5\frac{5}{8}$ ft. for a window shade.

Did they have enough left to make a shade for a window $1\frac{1}{2}$ ft. high in the shack door?

6. The boys had a roll of wire $40\frac{1}{2}$ ft. long.

After they had used enough to repair some chairs, they had only $9\frac{3}{4}$ ft. left. They had used ___?___ feet.



Watching baseball on television

Tom's aunt gave him 3 one-dollar bills for his birthday. He plans to use part of the money to watch big-league games on the television set at the Sports Center.

Explain how the subtractions below tell the story of Tom's money when he watches for 1 hour; for 2 hours; for 3 hours; for 4 hours.

WATCHES 1 HOUR	WATCHES 2 HOURS	WATCHES 3 HOURS	WATCHES 4 HOURS
$\$3 = \$2\frac{4}{4}$	$\$3 = \$2\frac{4}{4}$	$\$3 = \$2\frac{4}{4}$	$\$3 = \$2\frac{4}{4}$
$-\frac{1}{4} = \frac{1}{4}$	$-\frac{2}{4} = \frac{2}{4}$	$-\frac{3}{4} = \frac{3}{4}$	$-\frac{4}{4} = \frac{4}{4}$
HAS LEFT $\$2\frac{3}{4}$	HAS LEFT $\$2\frac{2}{4}$	HAS LEFT $\$2\frac{1}{4}$	HAS LEFT $\$2$

1. Name the smallest common denominator in each of these:

(*a*) $\frac{1}{2} + \frac{1}{6} + \frac{1}{12}$ (*b*) $\frac{1}{2} + \frac{1}{4} + \frac{1}{3}$ (*c*) $\frac{1}{2} + \frac{1}{5} + \frac{1}{10}$ (*d*) $\frac{1}{3} + \frac{1}{6} + \frac{1}{4}$

2. Reduce each of these fractions to lowest terms:

$\frac{6}{12}$ $\frac{9}{15}$ $\frac{12}{16}$ $\frac{12}{18}$ $\frac{10}{20}$ $\frac{10}{16}$ $\frac{15}{20}$ $\frac{16}{20}$

3. Change these improper fractions to mixed numbers:

$\frac{14}{4}$ $\frac{17}{3}$ $\frac{15}{6}$ $\frac{19}{6}$ $\frac{31}{10}$ $\frac{18}{5}$ $\frac{28}{6}$ $\frac{28}{8}$

4. Change each of these to its simplest form:

$3\frac{9}{6}$ $\frac{9}{9}$ $\frac{10}{5}$ $2\frac{6}{5}$ $\frac{18}{20}$ $4\frac{8}{6}$ $\frac{7}{4}$ $5\frac{12}{10}$

Using mixed numbers

1. When cantaloupes are selling at 3 for 25¢, one cantaloupe costs $\frac{1}{3}$ of 25¢, or $\underline{\ ?\ }$¢. You have to pay 9¢ for it.

How much would you have to pay for 1 apple when apples are selling at 3 for 10¢? 4 for 15¢? 5 for 19¢? 6 for 25¢? 8 for 30¢?

2. Bob and Dick stepped on a scale at the same time. Together they weighed $102\frac{1}{4}$ lb.

Bob stepped off the scale. The hand on the scale swung back to $48\frac{3}{4}$. How much did Dick weigh? Bob?

3. At 65¢ a pound, how much will $\frac{1}{2}$ lb. of butter cost? How much will $\frac{1}{4}$ lb. cost?

4. Tim's mother is making him a pair of corduroy pants. The pattern calls for $2\frac{3}{4}$ yd. of material.

She has 2 yd. 30 in. Has she enough material?

5. Christine saw two remnants of nylon. One was marked $1\frac{7}{8}$ yd. The other was marked $1\frac{3}{4}$ yd.

She wanted the longer piece. Which piece should she have taken?

Find the sum:

	a	b	c	d	e	f	g
6.	$3\frac{2}{3}$ $2\frac{1}{2}$ $1\frac{5}{12}$	$4\frac{1}{2}$ $\frac{4}{5}$ $4\frac{7}{10}$	$\frac{2}{3}$ $3\frac{1}{4}$ $8\frac{5}{6}$	$5\frac{5}{8}$ $2\frac{1}{2}$ $\frac{7}{16}$	$2\frac{1}{2}$ $2\frac{1}{8}$ $\frac{3}{4}$	$3\frac{5}{6}$ $\frac{2}{3}$ $\frac{1}{2}$	$2\frac{3}{4}$ $1\frac{1}{3}$ $\frac{1}{6}$
7.	$6\frac{5}{6}$ $8\frac{5}{12}$	$3\frac{2}{3}$ $2\frac{3}{4}$	$5\frac{9}{10}$ $2\frac{1}{2}$	$4\frac{5}{6}$ $\frac{2}{3}$	$8\frac{1}{4}$ $2\frac{7}{12}$	$16\frac{1}{2}$ $14\frac{1}{6}$	$7\frac{3}{4}$ $8\frac{1}{4}$

Find the difference:

	a	b	c	d	e	f	g
8.	$8\frac{1}{2}$ $\frac{5}{6}$	$6\frac{1}{3}$ $\frac{3}{4}$	$10\frac{3}{5}$ $\frac{3}{10}$	$12\frac{1}{4}$ $\frac{1}{12}$	$12\frac{1}{2}$ $\frac{1}{2}$	$9\frac{3}{8}$ $\frac{9}{16}$	$6\frac{1}{8}$ $\frac{7}{8}$
9.	$10\frac{5}{8}$ $2\frac{7}{8}$	$12\frac{1}{2}$ $2\frac{4}{5}$	8 $\frac{7}{8}$	$24\frac{1}{3}$ $4\frac{11}{12}$	$10\frac{1}{2}$ $8\frac{9}{16}$	$45\frac{1}{4}$ $1\frac{5}{8}$	$16\frac{1}{4}$ $6\frac{3}{8}$

Thinking out loud

1. Jerry paid 60¢ for a box of chocolate bars. There are 12 bars in the box.

Tom wants to buy one of the bars. How much should Jerry charge him for 1 bar? Tell what you think to solve this problem.

① Jerry thought this way:

"12 bars cost 60¢; so 1 bar costs $\frac{1}{12}$ of 60¢, or _?_¢."

② Tom thought this way:

"12 × *the cost of one bar* = 60¢; 12 × N = 60¢; so N = _?_.

"To find what number N stands for, I'll divide 60¢ by 12.

"The cost of 1 bar is 60¢ ÷ 12, or _?_¢."

Whose thinking do you understand better, Jerry's or Tom's?

Tell what you think in solving these problems:

2. At 3 for 10¢, a dozen oranges will cost _?_¢; $1\frac{1}{2}$ dozen oranges will cost _?_¢.

3. If Bobby fences a grassy plot 6 ft. long and 4 ft. wide for Cocky, his pet rooster, how many feet of fencing will he need?

4. If $\frac{1}{8}$ lb. of fudge costs 10¢, a pound will cost _?_¢; $1\frac{1}{2}$ lb. will cost _?_.

5. Tom saves 40¢ a week. At this rate, he should save 2 dollars in _?_ weeks.

6. One week Jimmy worked 5 hr. 15 min. in Mr. Smith's garden. Mr. Smith agreed to pay him 35¢ an hour.

Mr. Smith gave him $1.84 for the week's work. Was that the correct amount?

7. Sam bought a dozen balloons at 3 for 10¢. He sold them for 5¢ each. How much did he gain?

8. Peter has 15 problems to solve for homework. It has taken him 8 minutes to do 5 of them.

At the same rate, it will take him _?_ more minutes to finish.

9. At 2 for 5¢, you can buy _?_ plums for 25¢.

10. Tom walked 8 blocks in 12 minutes. Did he walk more than a block a minute, exactly a block a minute, or less than a block a minute?

11. How long did it take Tom (Ex. 10) to walk a block?

12. What part of a block did Tom (Ex. 10) walk in a minute?

Practice in subtracting mixed numbers

1. At Cook's Department Store, the clerk writes on a tag how much material is left in a piece of cloth after each sale.

Robert wants $7\frac{1}{2}$ yd. of striped awning cloth for camp chairs.

Can he get it from the piece in the picture? Look at the tag.

2. How does Cook's plan for marking the price tag save time?

3. In the box below, tell in each case how many yards the clerk should write as left in the piece.

Ex. *a* means that $3\frac{1}{4}$ yd. were sold from a piece $12\frac{5}{8}$ yd. long.

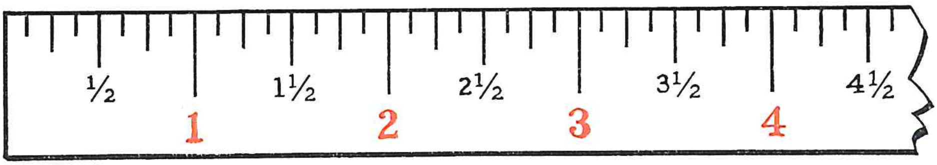
	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
YD. ON PIECE	$12\frac{5}{8}$	$10\frac{7}{8}$	$9\frac{3}{4}$	12	$14\frac{1}{8}$	$15\frac{1}{4}$	$16\frac{1}{2}$	$15\frac{1}{4}$	8
YD. SOLD	$3\frac{1}{4}$	$2\frac{5}{8}$	$8\frac{7}{8}$	$5\frac{3}{8}$	$2\frac{1}{2}$	$2\frac{7}{8}$	$\frac{7}{8}$	$2\frac{5}{8}$	$\frac{5}{8}$

Subtract:

	a	*b*	*c*	*d*	*e*	*f*	*g*
4.	$56\frac{7}{10}$ $45\frac{1}{2}$	$78\frac{7}{12}$ $35\frac{1}{3}$	$14\frac{7}{8}$ $12\frac{1}{4}$	$16\frac{5}{12}$ $15\frac{1}{4}$	$29\frac{7}{16}$ $15\frac{1}{4}$	$47\frac{7}{10}$ $35\frac{1}{5}$	$25\frac{7}{12}$ $13\frac{1}{3}$
5.	$85\frac{3}{16}$ $16\frac{13}{16}$	$79\frac{1}{4}$ $15\frac{7}{8}$	79 $5\frac{3}{8}$	84 $6\frac{5}{8}$	93 $4\frac{5}{16}$	$92\frac{1}{8}$ $17\frac{5}{8}$	$72\frac{5}{8}$ 46

6. Do Exs. 4 and 5 as addition examples.

Subtracting with the fraction scale



1. The ruler is marked off into halves, fourths, and ___?___ of inches.

2. To subtract $1\frac{1}{2}$ from 4, start at 4 and count back $\frac{1}{2}$ to $3\frac{1}{2}$. Then count back 1 to ___?___.
So $4 - 1\frac{1}{2} =$ ___?___.

3. Tell what you would do to subtract $2\frac{1}{2}$ from 4.

4. To subtract $1\frac{1}{2}$ from $4\frac{1}{4}$, start at $4\frac{1}{4}$ and count back $\frac{1}{2}$, or $\frac{2}{4}$, to $3\frac{3}{4}$. Then count back 1 to ___?___.
So $4\frac{1}{4} - 1\frac{1}{2} =$ ___?___.

5. To subtract $1\frac{1}{2}$ from $4\frac{1}{8}$, start at $4\frac{1}{8}$ and count back $\frac{1}{2}$, or $\frac{4}{8}$, to $3\frac{?}{8}$. Then count back 1 to ___?___.
So $4\frac{1}{8} - 1\frac{1}{2} =$ ___?___.

Use a mental picture of a ruler to do these:

	a	b	c	d	e
6.	$3\frac{1}{4} - \frac{1}{2}$	$3 - \frac{3}{8}$	$8\frac{3}{4} - 5\frac{7}{8}$	$4\frac{1}{8} - 2\frac{7}{8}$	$3\frac{1}{8} - \frac{5}{8}$
7.	$3\frac{1}{4} - \frac{3}{8}$	$4 - 3\frac{5}{8}$	$4\frac{3}{8} - 2\frac{7}{8}$	$3\frac{1}{2} - \frac{5}{8}$	$3\frac{1}{4} - \frac{7}{8}$
8.	$4\frac{1}{8} - 3\frac{3}{4}$	$4 - 3\frac{3}{4}$	$3\frac{1}{4} - \frac{5}{8}$	$3\frac{5}{8} - \frac{3}{4}$	$4\frac{3}{8} - 3\frac{3}{4}$

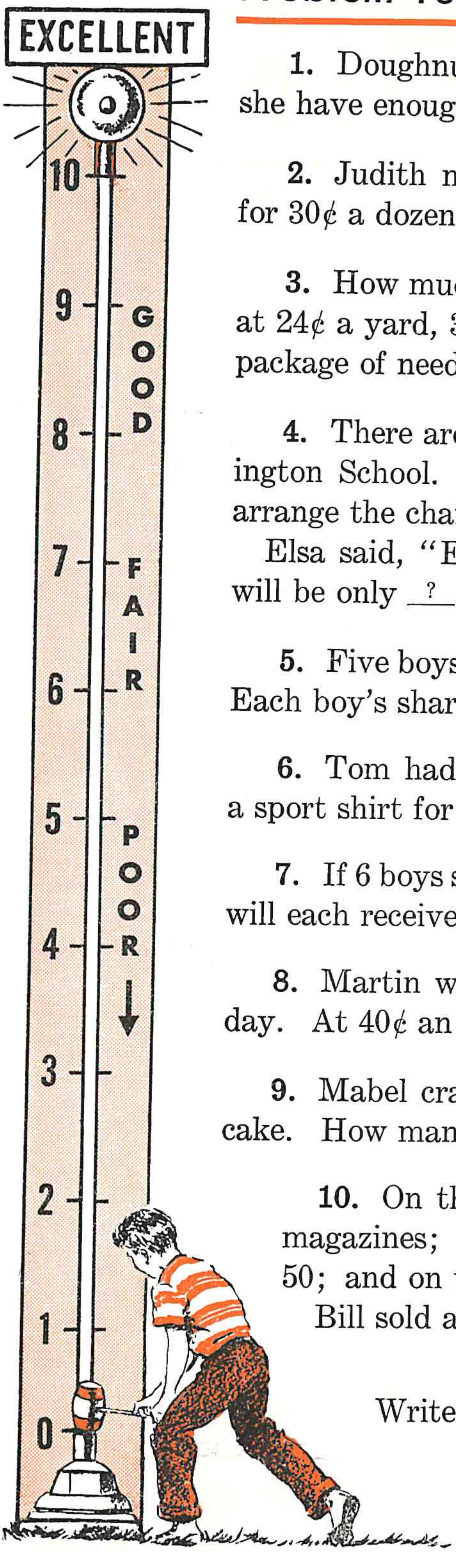
Miss Blaine had each of her pupils bring to class a subtraction problem with fractions. Here are 4 of the best problems. Can you do them mentally?

9. Roy picked out $2\frac{3}{4}$ pounds of walnut meats. He has orders for $1\frac{7}{8}$ pounds. He will have ___?___ pounds left.

10. Last year Sue's little spruce tree was $6\frac{7}{8}$ inches tall. This year it is $11\frac{3}{4}$ inches tall. The tree has grown ___?___ inches in the year.

11. Tom has orders for $3\frac{3}{4}$ gallons of hickory nuts. He has gathered $2\frac{7}{8}$ gallons. How many more gallons must he gather?

12. On a 12-mile hike a Scout troop walked $4\frac{5}{8}$ mi. before lunch, $5\frac{1}{2}$ mi. in the afternoon, and ___?___ mi. in the evening after supper.



Problem Test 6

1. Doughnuts are 28¢ a dozen. Alice has \$1.10. Does she have enough to buy 4 doz. doughnuts?

2. Judith made 12 doz. cookies. She sold $\frac{1}{4}$ of them for 30¢ a dozen. She received __?__ for them.

3. How much should Margaret pay for $5\frac{1}{2}$ yd. of ribbon at 24¢ a yard, 3 spools of thread at 5¢ each, and a 10-cent package of needles?

4. There are 560 chairs in the auditorium of the Washington School. The Spring Festival committee wishes to arrange the chairs with 40 chairs in a row.

Elsa said, "Everybody will be able to hear, since there will be only __?__ rows."

5. Five boys hired a rowboat for 3 hours, at 35¢ an hour. Each boy's share of the cost was __?__.

6. Tom had \$10. He bought a sweater for \$5.98 and a sport shirt for \$1.98. He had __?__ left.

7. If 6 boys share equally 5 candy bars, how much candy will each receive?

8. Martin worked $3\frac{1}{2}$ hr. one day and $2\frac{3}{4}$ hr. the next day. At 40¢ an hour, how much did he earn?

9. Mabel cracked $2\frac{1}{8}$ lb. of nuts. She used $\frac{3}{4}$ lb. for a cake. How many pounds were left?

10. On the first Saturday in February Bill sold 54 magazines; on the second Saturday, 48; on the third, 50; and on the fourth, 56.

Bill sold an average of __?__ each Saturday.

Write your score on your Problem Test Record.

Self-Help Test 13

1. Write this number in words: 8,604,517. **(6)**

2. Write with dollar sign and cents point:
15 dollars 250¢ $33\frac{1}{3}$¢ 3¢ **(111)**

3. Write Roman numerals for 18, 39, 59, and 74. **(27–28)**

4. Estimate the sum of $68, $41.08, $.59, and $252.98. **(11)**

5. James had $70 in the bank. A few days later he drew out $18.75. How much was left in the bank? **(17)**

6. At 3¢ each, how much will 5 doz. cakes cost? **(36)**

7. The Midtown Boys' Club received a bill for $22.95. If 15 members share the payment equally, how much will each pay? **(192)**

8. Jack works in his father's hardware store. How much change should he give a customer who pays a bill for $2.73 with a 5-dollar bill? What coins should he give? **(114)**

9. If 7 boys share equally 294 pennies, how many will each boy get? **(59–61)**

Self-Help Test 14

1. $23\overline{)72}$ **(80)**	**2.** $64\overline{)5978}$ **(96–97)**	**3.** $26\overline{)7852}$ **(189)**	**4.** $32\overline{)26880}$ **(191)**
5. $43\overline{)304}$ **(81)**	**6.** $87\overline{)5894}$ **(128)**	**7.** $76\overline{)45828}$ **(189)**	**8.** $49\overline{)38123}$ **(196)**
9. $24\overline{)984}$ **(92)**	**10.** $43\overline{)9162}$ **(174)**	**11.** $12\overline{)420}$ **(128)**	**12.** $47\overline{)39505}$ **(189)**

13. How many 24-cent gifts can you buy for $5.00? **(193)**

14. Jean wants to make 2 new blouses. She finds she needs 81 inches of material for each, or __?__ inches of material in all. How many yards does she need? **(219)**

15. The 23 songbooks bought for a fifth-grade class cost $14.95. What was the cost of each songbook? **(192)**

16. Edgar bought six 20-ounce packages of gravel. Is that more or less than 10 lb.? **(85)**

Self-Help Test 15

1. Supply the missing numbers: $\frac{3}{4} = \frac{?}{8} = \frac{?}{12} = \frac{?}{16}$ (144)
2. Change to mixed numbers: $\frac{31}{8}$ $\quad \frac{27}{4}$ $\quad \frac{43}{6}$ $\quad \frac{38}{5}$ (124–125)
3. Reduce to lowest terms: $\frac{10}{16}$ $\quad \frac{6}{10}$ $\quad \frac{18}{24}$ $\quad \frac{15}{20}$ (148)
4. Express in best form: $\frac{36}{8}$ $\quad \frac{45}{6}$ $\quad \frac{52}{10}$ $\quad \frac{30}{12}$ (223)
5. To add $\frac{1}{2}$, $\frac{3}{8}$, and $\frac{3}{16}$, use __?__ for the common denominator. (215–216)
6. The common denominator of $\frac{1}{3}$ and $\frac{1}{4}$ is __?__. (215)

Self-Help Test 16

1. $\frac{3}{5} + \frac{1}{5}$ (136–137)
2. $\frac{1}{2} + \frac{1}{4}$ (145)
3. $\frac{7}{8} + \frac{3}{4}$ (145)
4. $7\frac{11}{16} + 3\frac{7}{16}$ (223)
5. $\frac{1}{3} + \frac{1}{4}$ (215)
6. $\frac{2}{5} + \frac{1}{10}$ (148)
7. $4\frac{3}{8} + 1\frac{1}{4}$ (151)
8. $2\frac{1}{6} + 1\frac{2}{3}$ (151)
9. $4\frac{3}{8} + 2\frac{3}{8}$ (217)
10. $7\frac{2}{3} + 1\frac{1}{2}$ (218)
11. $2\frac{3}{4} + 6\frac{7}{12}$ (223)
12. $5\frac{1}{12} + 1\frac{1}{6}$ (217)

Self-Help Test 17

1. $\frac{2}{3} - \frac{1}{3}$ (136)
2. $\frac{7}{8} - \frac{1}{4}$ (146)
3. $\frac{7}{8} - \frac{3}{8}$ (148)
4. $\frac{2}{3} - \frac{1}{4}$ (215–216)
5. $4\frac{3}{4} - 2\frac{1}{8}$ (152)
6. Draw a diagram to prove that $1 - \frac{5}{8} = \frac{3}{8}$ (232)
7. Draw a diagram to prove that $5 - \frac{2}{3} = 4\frac{1}{3}$ (232)
8. $2\frac{1}{4} - \frac{3}{4}$ (233)
9. $4\frac{3}{8} - \frac{1}{2}$ (234)
10. $5\frac{1}{4} - \frac{1}{3}$ (234)
11. $8\frac{1}{5} - 1\frac{1}{2}$ (235)
12. $8\frac{5}{16} - 2\frac{5}{8}$ (235)

Measuring your growth in arithmetic

Work carefully. Check your answers. Be sure all answers are sensible. If there is a fraction in the answer, express it in best form.

1. $3\frac{5}{6} + 6\frac{2}{3}$

2. $5\frac{4}{5} + 10\frac{1}{2}$

3. $20\frac{5}{6} - 12\frac{1}{4}$

4. $8 - 2\frac{3}{8}$

5. $6\frac{1}{12} - 1\frac{3}{4}$

6. Change these improper fractions to mixed numbers and reduce fractions to lowest terms:

$\frac{28}{8}$ $\frac{27}{12}$ $\frac{39}{9}$ $\frac{48}{10}$ $\frac{45}{12}$

7. It took an American pilot 60 hr. of flying time to deliver a message in India. How many days was that?

Don't forget to reduce the fraction in your answer.

8. Ed's mother has 50 ft. of rope. She needs $32\frac{1}{2}$ ft. for a clothesline. Ed will use the rest, which is __?__ ft., for a lasso.

9. Owen bought a piece of felt $\frac{2}{3}$ yd. long for his small pool table. The clerk cut it from a piece marked $5\frac{1}{3}$ yd.

The clerk then marked the tag on the piece that was left to show that he still had __?__ yd.

10. Willard's brother is a high school pole-vaulter. At the high school field meet he cleared the bar at a height of $10\frac{3}{4}$ ft. The winner cleared the bar at a height of $11\frac{1}{4}$ ft.

By how much was Willard's brother beaten?

Just for fun

Ask a friend to:

- write down any number from 1 to 5.
- add to it any number from 5 to 9.
- subtract 4 from the sum.
- multiply by 9.
- cross out any figure in the answer except a zero.
- tell you what number is left in his answer.

You subtract this number from 9. The result tells you the figure he crossed out.

Square feet

1. The floor of the rumpus room in Tom's home is covered with rubber-like tiles. Each tile is a square, 1 foot on each side.

On the blackboard draw a square to show the exact size of one of the tiles.

A square 1 foot long and 1 foot wide is a ***square foot*** (sq. ft.).

2. Tom's mother asked him to polish the rumpus-room floor.

Tom read on the can of floor polish, "Use 1 quart to each 500 square feet of floor space."

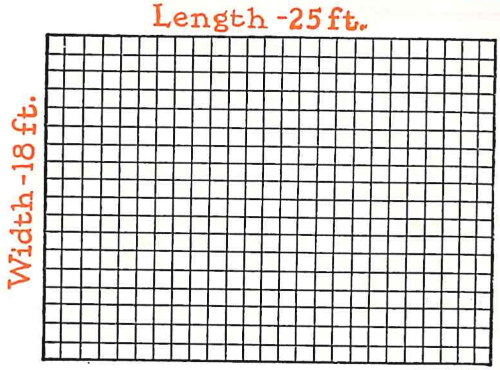
Tom knew that the rumpus room was 25 ft. long and 18 ft. wide. He didn't know how many square feet there were in it; so he didn't know how much polish to use.

If you had been Tom, how would you have found out how many square feet there were in the floor?

3. Tom said, "Each tile is 1 square foot. I can find how many square feet there are in the floor by counting the tiles."

He counted the tiles in one row along the length of the room. There were 25. How could he have known there were 25 without counting?

What do you think Tom should have done next?



4. Tom counted the tiles in the next row. There were __?__. He said, "There's no use doing all this counting. There are __?__ tiles in each row."

5. How many rows of 25 tiles were there? How can you tell without counting?

6. How many tiles were there in the whole floor? How many square feet?

Tom said he would need to use a little less than a quart of floor polish. How did he figure that? (The information in Ex. 2 will help you.)

7. If the rumpus room had been 22 ft. long and 16 ft. wide, how many tiles would have been needed?

8. Would $\frac{1}{2}$ quart of floor polish be enough for the rumpus room in Ex. 7?

Square feet

1. On the board draw a rectangle 4 feet long and 3 feet wide.

Draw lines a foot apart across the length and the width of the rectangle.

The rectangle contains _?_ square feet.

2. Enlarge the rectangle you drew in Ex. 1. Make it 1 ft. longer and 1 ft. wider. Extend the lines you drew inside the rectangle.

The new rectangle is _?_ ft. long and _?_ ft. wide.

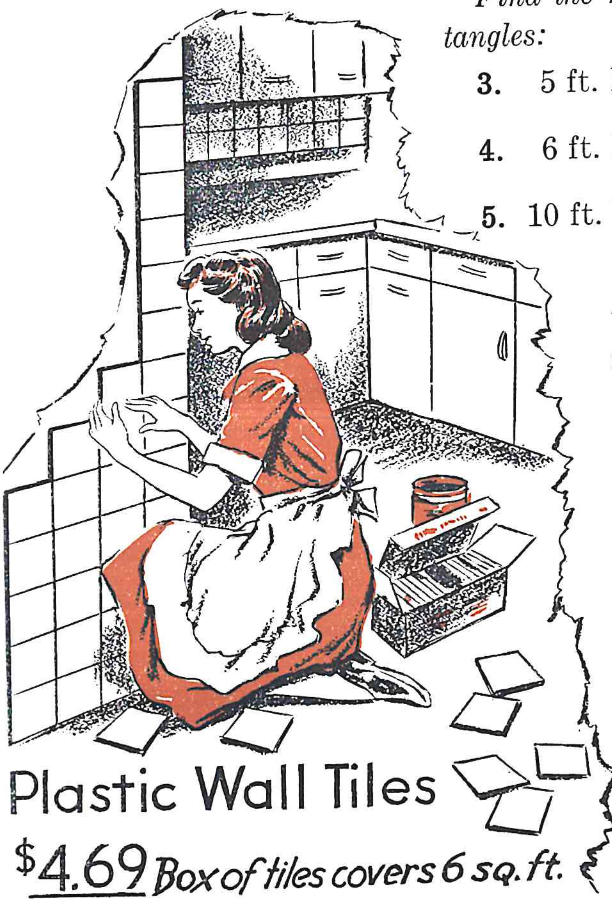
It contains _?_ square feet.

Find the number of square feet in these rectangles:

3. 5 ft. long, 3 ft. wide
4. 6 ft. long, 1 ft. wide
5. 10 ft. long, 7 ft. wide
6. $9' \times 7'$
7. $8' \times 6'$
8. $10' \times 9'$

9. At 8¢ a square foot, find the cost of having rugs of these sizes cleaned:

$9' \times 12'$ $8' \times 10'$ $12' \times 15'$



10. Bill's mother saw this advertisement of wall tiles. She would like to have the wall above her stove covered with tile. She asked Bill how much it would cost.

Bill measured and found the space she wanted to cover was 6 ft. long and 2 ft. wide.

He said, "You would need _?_ boxes of tiles; so the cost would be _?_."

The number of square feet in a rectangle equals the number of rows 1 foot wide times the number of square feet in a row.

Square inches

When Barbara's fudge was finished, she cut it into squares.

Look at the picture. How many pieces of fudge are there in each row? How many rows are there? How many pieces in all?

Think, "Since there are 4 rows with 8 pieces in a row, there must be 4 times 8 pieces, or _?_ pieces."

Each piece of fudge is 1 inch long and 1 inch wide. A square 1 inch long and 1 inch wide is a ***square inch*** (sq. in.).

1. Starting at a corner of your paper, draw a square 1 inch long and 1 inch wide. Cut out the square inch.

2. Draw a rectangle 3 inches long and 2 inches wide. Draw lines an inch apart across the length and the width of your rectangle.

How many square inches are there in it? Prove your answer by using the square inch you cut out.

Make a rule for finding the number of square inches in a rectangle. Then find the number of square inches in these rectangles:

3. 5 inches long, 3 inches wide

4. 4 inches long, 1 inch wide

5. $9'' \times 6''$

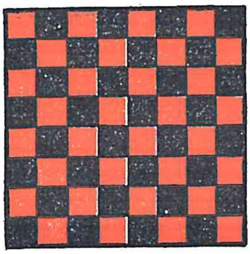
6. $7'' \times 5''$

7. $4'' \times 9''$

8. $6'' \times 7''$

The number of square inches in a rectangle equals the number of rows 1 inch wide times the number of square inches in a row.

Finding areas



1. In this picture of a checkerboard there are __?__ squares in each row.

How many rows are there? How many squares in the whole checkerboard?

2. How many tiles would be needed for a bathroom if there were 6 rows, with 14 tiles in each row? 7 rows, with 12 tiles in each row? 8 rows, with 16 tiles in each row?

3. Tom was selling Christmas seals. Each sheet of seals contained 10 rows of seals, with 10 seals in each row. How many seals were there in a sheet?

4. Mary asked Tom for 25 seals. He handed her 5 rows of seals, with 5 seals in a row. Was that 25 seals?

5. The floor of the closet in Larry's room measures 4 ft. by 2 ft. How many square feet are there in the floor of the closet?

6. The number of square inches or square feet in a rectangle is its ***area.*** Find the area of Fred's room, which is 15 ft. $\times$ 13 ft.

Find the areas of rectangles having these dimensions:

7. 4 ft. long, 1 ft. wide

8. 8 ft. long, 5 ft. wide

9. 20 ft. long, 15 ft. wide

10. $10' \times 6'$

11. $16' \times 8'$

12. $40' \times 32'$

13. $19' \times 13'$

14. $17' \times 24'$

15. $25' \times 33'$

16. The Watkins' front porch measures $30' \times 12'$. How many square feet are there in its floor?

17. The back porch measures $14' \times 8'$. Find its area.

18. The lawn is 80 ft. wide and 120 ft. long. How many square feet of lawn are there to mow?

19. A pound of grass seed is enough to sow 200 sq. ft. Will 25 lb. of seed be enough to sow a plot $100' \times 60'$? Will 30 lb. be enough?

20. Four pounds of All-Purpose Fertilizer are needed for 100 sq. ft. of garden. Will a 50-pound bag be enough to fertilize a garden $40' \times 30'$?

21. A $4' \times 10'$ rectangle is __?__ times as large as a $2' \times 5'$ rectangle.

Using square yards to measure area

1. Draw on the blackboard a square 1 yard long and 1 yard wide. A square that is 1 yard long and 1 yard wide is a ***square yard*** (sq. yd.).

Draw lines on the square yard on the blackboard, dividing it into square feet.

How many square feet are in 1 row? How many rows are there? How many square feet, then, are there in a square yard?

2. Draw on the blackboard a square 1 foot long and 1 foot wide.

Draw lines on the square foot on the blackboard, dividing it into square inches.

How many square inches are in each row? How many rows of square inches are there in the square foot?

How many square inches, then, are there in a square foot?

LEARN THESE

MEASURES OF LENGTH	MEASURES OF SURFACE
12 in. = 1 ft.	**144 sq. in. = 1 sq. ft.**
3 ft. = 1 yd.	**9 sq. ft. = 1 sq. yd.**

Tell the missing numbers:

3.	18 feet = ? yards	18 square feet = ? square yards
4.	3 feet = ? inches	3 square feet = ? square inches
5.	5 yards = ? feet	5 square yards = ? square feet
6.	27 feet = ? yards	27 square feet = ? square yards
7.	288 inches = ? feet	288 square inches = ? square feet
8.	8 feet = ? inches	8 square feet = ? square inches

9. To find how many square yards there are in 58 sq. ft.:

- Larry divided 58 by 9 and got $6\frac{4}{9}$ for his answer. He said "That means there are $6\frac{4}{9}$ sq. yd. in 58 sq. ft."
- Julia divided 58 by 9 and got 6 r4 for her answer. She said "That means there are 6 sq. yd. and 4 sq. ft. more in 58 sq. ft.
- Were Larry and Julia both right? Does 4 sq. ft. equal $\frac{4}{9}$ sq. yd.?

Area and perimeter

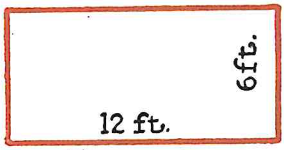


Figure A

Figure B

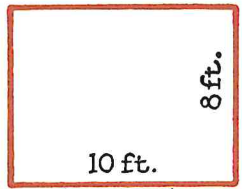


Figure C

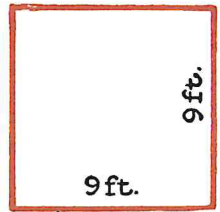


Figure D

The Neighborhood Boys' Club is going to have a marble-shooting contest. The boys have a rope 36 feet long, for roping off the place where the contest will be held.

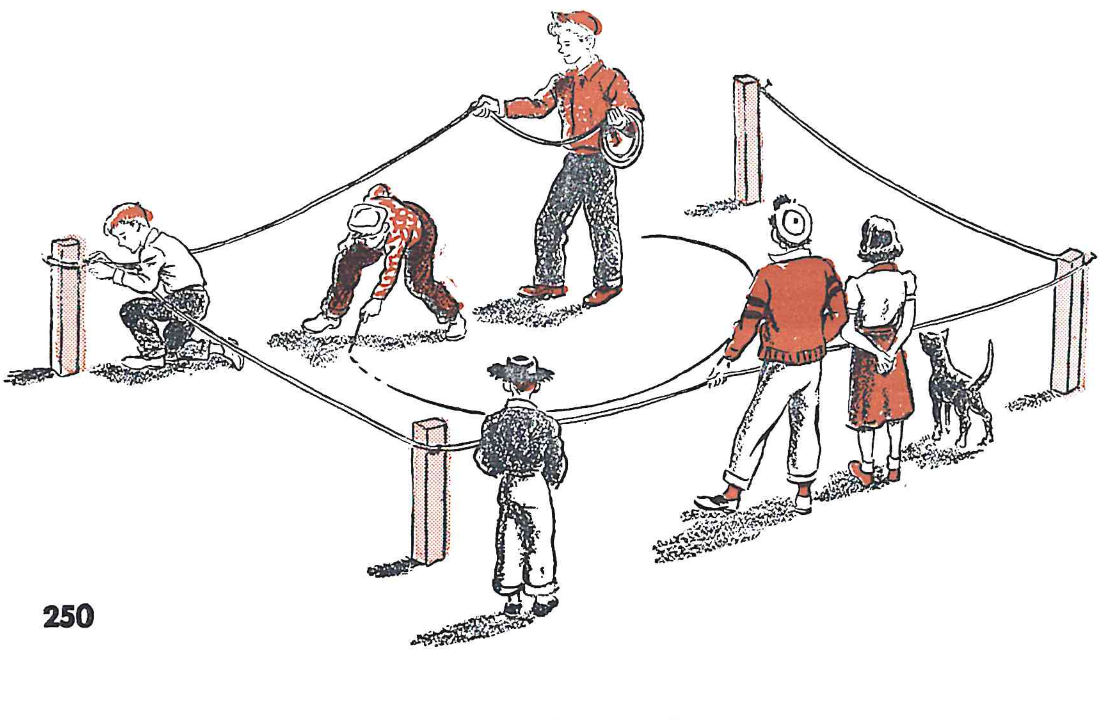
They want to make the largest space possible in the form of a rectangle.

1. Billy suggested roping off a rectangle like Figure A, 6 ft. wide and 12 ft. long. Can they make one that size with 36 ft. of rope? Would there be any rope left?

2. How many square feet are there in a rectangle 6 ft. wide and 12 ft. long? Look at Figure A.

3. Don said, "If we make the playing space 7 ft. wide and 11 ft. long (Figure B), it will have a larger area than if we make it 6′ by 12′ (Figure A)." Prove that Don is right.

4. Prove that Don can rope off a rectangle $7' \times 11'$ with 36 ft. of rope.



5. Jerry said, "Let's rope off a rectangle 8 ft. wide and 10 ft. long" (Figure C). Can they make a rectangle that size with 36 ft. of rope?

6. How many square feet are there in a rectangle $8' \times 10'$ (Figure C)? Is that larger than rectangles A and B?

7. Joe said, "Why don't we rope off a square 9 ft. wide and 9 ft. long?"
Have the boys enough rope to make a rectangle that size (Figure D)? How many square feet would there be in this rectangle?

8. Which rectangle has the largest area of all the rectangles suggested?

9. If the boys rope off a rectangle 13 feet long, how wide can they make it, using their 36 ft. of rope?
Would this rectangle be smaller or larger than rectangle A?

10. What is the perimeter of rectangle A? rectangle B? rectangle C? rectangle D?

11. Can two rectangles have the same perimeter without having the same area? Give some illustrations of this idea.

12. If you know that the perimeter of a square is 12 in., how can you find the length of each side without measuring?

13. The dimensions of a rectangle are 6 ft. and 20 ft. What is its area? its perimeter?

Tell whether these statements are true or false:

14. The perimeter of a rectangle $9' \times 12'$ is 42 sq. in., and its area is 108 sq. in.

15. The area of a rectangle is one of its dimensions.

16. The area of a rectangle 9′ long and 12′ wide is 12 sq. yd.

17. 144 sq. in. is the same area as 1 sq. ft.

18. In the area of any rectangle there are more square inches than there are square feet.

19. The area of a rectangle $\frac{1}{2}$ ft. wide and 2 ft. long is 1 sq. ft.

20. A square yard is three times as large as a square foot.

21. If you double the dimensions of a rectangle, its area also will be doubled.

22. You cannot measure area with a ruler.

Using your head

1. How many square yards are there in 27 sq. ft.? 18 sq. ft.? 9 sq. ft.?
2. To find the number of square inches in 5 sq. ft., you __?__ 144 by __?__.
3. To find the number of square yards in 72 sq. ft., you __?__ 72 by __?__.
4. There are __?__ square inches in 10 square feet.
5. Find the areas: (*a*) 2″ × 2″ (*b*) 9′ × 13′ (*c*) 8 yd. by 7 yd.

Does the Hint System give the correct quotient figures in each of these divisions? Do the divisions.

	a	b	c	d	e	f
6.	$63\overline{)252}$	$73\overline{)365}$	$85\overline{)765}$	$95\overline{)760}$	$49\overline{)392}$	$58\overline{)406}$
7.	$54\overline{)432}$	$46\overline{)230}$	$67\overline{)536}$	$39\overline{)156}$	$74\overline{)592}$	$27\overline{)135}$

Copy and work:

	a	b	c	d	e	f
8.	$87 - 75$	$104 - 89$	$275 - 164$	$549 - 78$	$654 - 403$	$803 - 275$
9.	63×5	80×8	79×6	68×9	507×7	983×6
10.	$65 + 85$	$168 + 251$	$247 + 353$	$\frac{1}{4} + \frac{3}{8}$	$\frac{3}{5} + \frac{1}{10}$	$\frac{3}{4} + \frac{2}{3}$

11. If 6 oranges cost 29¢, how much does one orange cost?

12. At 5¢ each, how many pencils can you buy with $2.00?

13. How much change would you get from $5.00 after a $2.43 purchase?

14. 15 oz. of cheese would be how much heavier than $\frac{3}{4}$ lb. of cheese?

15. Tell the answers to the addition facts on page 305, the subtraction facts on page 306, the multiplication facts on page 307, and the divisions on page 308.

A page of practice

PRACTICE SET I

1. Find the sum of 6, 7, 5, 8, and 9.

2. Find the sum of 27, 65, 84, 70, and 99.

3. Find the area and the perimeter of a lawn 4 ft. by 8 ft.

4. Find the difference between 3007 and 2543.

5. 1 sq. ft. = _?_ sq. in.
1 sq. yd. = _?_ sq. ft.

6. To change inches to feet, divide by _?_.
To change square inches to square feet, divide by _?_.

7. At 15¢ each, how many electric-light bulbs can you buy for \$2.00? Will there be any money left over?

8. How much would you have left from \$10.00 after buying a dozen towels at 65¢ each?

PRACTICE SET II

1. $6784 - 3059$

2. 739×605

3. $41583 \div 83$

4. 240×248

5. $12456 - 9875$

6. 208×460

7. $19000 - 8090$

8. $5684 \div 28$

9. $5 - 1\frac{1}{2}$

10. $\frac{7}{8} + \frac{1}{8}$

11. $\frac{5}{6} - \frac{1}{12}$

12. $\frac{2}{3} - \frac{1}{2}$

PRACTICE SET III

1.	**2.**	**3.**	**4.**	**5.**
275	654	\$12.75	\$31.79	\$67.92
392	807	8.24	29.98	59.01
776	967	9.63	94.75	17.27
59	534	14.75	37.69	8.51
987	78	8.66	9.84	27.46

6. 75×409

7. $2410 \div 75$

8. $\frac{1}{6} + \frac{2}{3}$

9. $\frac{7}{8} + \frac{1}{4}$

10. $\frac{7}{10} - \frac{1}{2}$

11. $\frac{3}{10} + \frac{1}{2}$

12. $\frac{1}{4} + \frac{3}{8}$

13. $\frac{1}{2} + \frac{1}{10}$

UNIT 29

Bar graphs. Finding averages. Zeros in quotients. Using plans in construction work

Raising money for a Community Park

All the classes in the Pine Grove School are helping to earn money to build a Community Park. The graph at the bottom of the page shows how much money each class has earned for the Park.

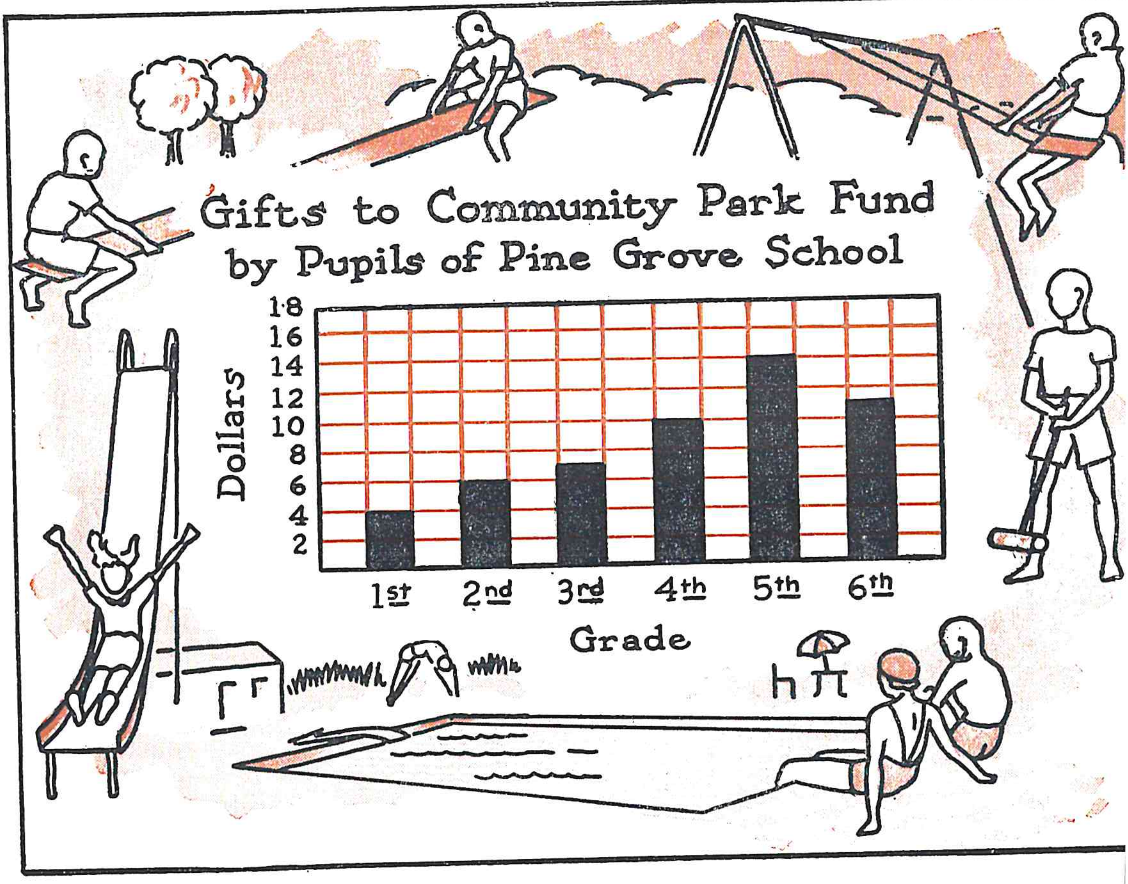
1. The bar showing how much the first grade has earned extends up to the line marked 4. That means the first grade has earned _?_ dollars.

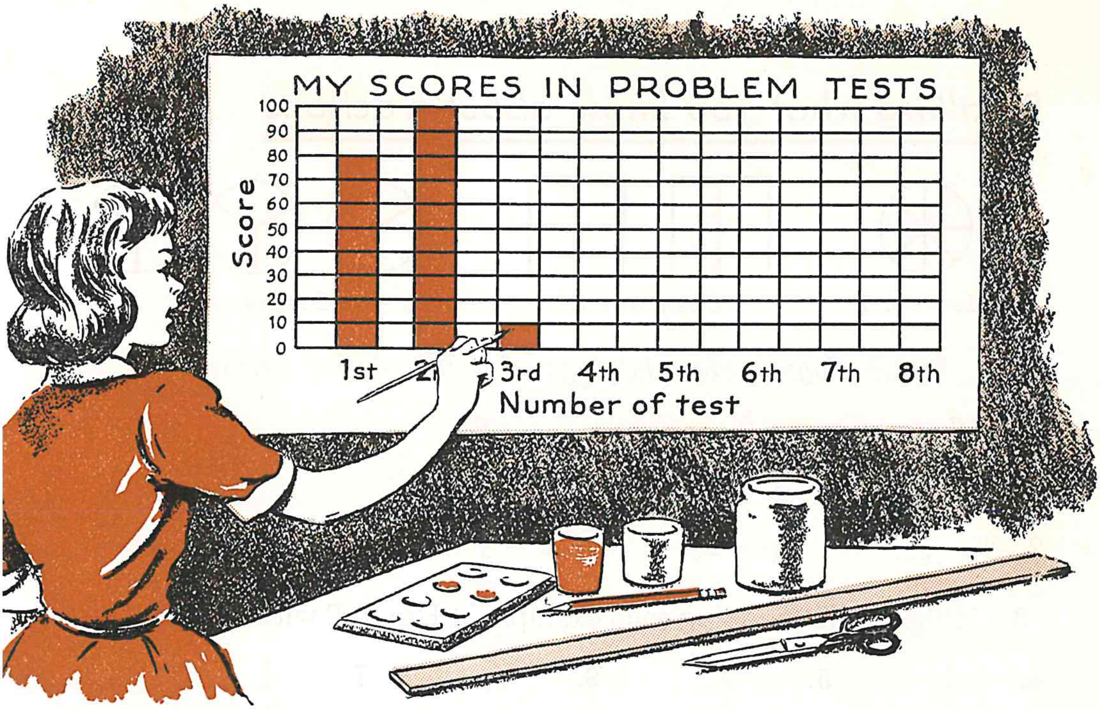
2. The graph shows that the second grade has earned _?_ dollars.

3. The bar showing how much the third grade has earned goes up to halfway between the line marked 6 and the line marked 8. That means the third grade has earned _?_ dollars.

4. How much has the fourth grade earned? the fifth grade? the sixth grade?

5. Can you tell at a glance which grade has earned the most money? which grade has earned least?





Showing test scores on a graph

Ruth's arithmetic book is just like yours. Every time she takes a Problem Test, she writes her score on her Problem Test Record.

Now she is making a graph to show her test scores.

1. What was Ruth's score on the first test? on the second test?

2. Make a bar graph like Ruth's. Use squared paper and a ruler.

Draw bars to show that Ruth got 90 in the third test, 100 in the fourth, 100 in the fifth, and 70 in the sixth.

3. Make a graph to show that Jean's marks on five Problem Tests were 60, 50, 70, 80, and 90.

4. Make a bar graph to show your scores on the Problem Tests. Use your Problem Test Record.

5. Make a graph to show that Walter's marks on 5 spelling tests were 75, 80, 85, 70, and 80.

6. What was Walter's average mark on the 5 spelling tests?

Which of the 5 tests pulled his spelling average down? Which test pulled his average up?

7. Make a bulletin-board display of interesting bar graphs you find in newspapers and magazines.

Explain the story that each graph tells.

Recalling what you know about fractions

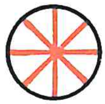


Diagram 1

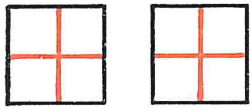


Diagram 2

Diagram 3

Which diagram above helps you find the missing number?

	a	b	c	d
1.	$\frac{1}{4} = \frac{?}{8}$	$\frac{4}{8} = \frac{?}{?}$	$\frac{3}{4} + \frac{1}{8} = \underline{\ ?\ }$	$1\frac{1}{4} + \frac{3}{4} = \underline{\ ?\ }$
2.	$\frac{3}{4} = \frac{?}{8}$	$\frac{8}{3} = 2\frac{?}{?}$	$2 - \frac{3}{4} = \underline{\ ?\ }$	$2\frac{2}{3} - 1\frac{1}{3} = \underline{\ ?\ }$

3. Make a rule for doing each example in Exs. 1–2 without a diagram.

4. $\begin{array}{r} \frac{1}{6} \\ + \frac{1}{3} \\ \hline \end{array}$	**5.** $\begin{array}{r} \frac{3}{5} \\ - \frac{3}{10} \\ \hline \end{array}$	**6.** $\begin{array}{r} \frac{5}{12} \\ + \frac{1}{2} \\ \hline \end{array}$	**7.** $\begin{array}{r} \frac{7}{8} \\ - \frac{3}{16} \\ \hline \end{array}$	**8.** $\begin{array}{r} \frac{2}{3} \\ + \frac{1}{4} \\ \hline \end{array}$

9. $\frac{7}{12} + \frac{3}{4}$ **10.** $\frac{1}{8} + \frac{1}{4} + \frac{1}{2}$ **11.** $\frac{3}{4} + \frac{2}{3} + \frac{1}{2}$

12. $\frac{1}{8} + \frac{3}{8} + \frac{1}{4}$ **13.** $\frac{1}{12} + \frac{1}{4} + \frac{1}{3}$ **14.** $\frac{2}{5} + \frac{1}{2} + \frac{2}{10}$

15. What part of a pound is 2 oz.? 3 oz.? 4 oz.? 5? 6? 7? 8? 10? 12?

16. Barbara practices her music lesson $\frac{1}{4}$ hour in the morning and $\frac{1}{2}$ hour in the afternoon. What part of an hour does she practice in a day?

17. If you have \$5 changed into quarters, how many quarters will you get? This shows that $5 = \frac{?}{4}$.

18. Which is larger, $\frac{5}{8}$ or $\frac{3}{4}$? Make a drawing on the blackboard to prove your answer.

19. What is an easy way to tell, without using a drawing, which of two fractions is larger?

20. Find the cost of 9 inches of pipe that sells for 20¢ a foot.

21. Which of the following fractions are equal?

$\frac{1}{2}$ $\frac{2}{3}$ $\frac{3}{6}$ $\frac{3}{4}$ $\frac{4}{8}$ $\frac{5}{10}$ $\frac{2}{4}$

22. Which of these fractions is larger than 1?

$\frac{5}{6}$ $\frac{9}{10}$ $\frac{3}{2}$ $\frac{7}{8}$ $\frac{8}{7}$ $\frac{4}{3}$ $\frac{15}{16}$

23. $3\frac{3}{4} + \underline{\ ?\ } = 5\frac{1}{8}$

Finding averages

	BARBARA D.	ROBERT C.	GEORGE F.	SARA H.	BETTY M.	ALICE R.	BILL R.	JACK T.	EARL W.
Sept.	94	84	70	80	78	98	76	88	70
Oct.	96	86	76	×	76	100	74	92	×
Nov.	86	80	78	82	80	94	×	100	68
Dec.	90	78	×	74	70	98	×	94	70
Jan.	×	90	68	78	68	100	×	×	74
Feb.	96	82	72	76	×	96	78	100	×
Mar.	94	86	76	84	78	92	80	92	66

Barbara's class has a 50-word spelling test every month.

Above are the marks some of the children have received on their tests so far this year. × means the child was absent when the test was given. Barbara missed the January test.

To find her average, Barbara first added her grades. The sum is _?_. Why did Barbara then divide the sum by 6?

$$\begin{array}{r} 92\frac{2}{3} \\ 6\overline{)556} \\ \underline{54} \\ 16 \\ \underline{12} \\ \frac{4}{6} = \frac{2}{3} \end{array}$$

When she divided by 6, she got a remainder of 4. She expressed the remainder as $\frac{4}{6}$; then she reduced $\frac{4}{6}$ to $\frac{2}{3}$, and wrote $\frac{2}{3}$ in the quotient.

Barbara's average was $92\frac{2}{3}$.

1. Which of Barbara's marks pulled her average up? Which of her marks pulled her average down?

2. First estimate the average for each of the other pupils; then find the average.

3. Who is the best speller in the group? the poorest speller?

4. What needs do you have for finding averages? Tell the class about them.

5. Tell what this statement means: Harry is above average in reading and arithmetic in his class, but he is below average in penmanship.

Zeros in division

1. During the month of March, Larry gathered 2,170 eggs.

To find how many eggs his chickens laid in a day on the average, you should divide ? by ?.

Would 7 be a sensible answer?

How can you tell that the answer is a 2-figure number?

Now do the division.

2. Sometimes zeros may cause trouble in division. Can you explain these two examples?

Try to work them without the help of the book.

$$\begin{array}{r} 50\text{ r6} \\ 36\overline{)1806} \\ \underline{180} \\ 6 \end{array} \qquad \begin{array}{r} 400\text{ r14} \\ 51\overline{)20414} \\ \underline{204} \\ 14 \end{array}$$

Tell how many figures there will be in each quotient below. Next tell where you write the first quotient figure. Then estimate each quotient. Finally, divide and check.

	a	b	c	d	e
3.	$26\overline{)5226}$	$35\overline{)7000}$	$41\overline{)12382}$	$62\overline{)1242}$	$67\overline{)13420}$
4.	$34\overline{)6936}$	$46\overline{)18630}$	$54\overline{)32836}$	$63\overline{)19225}$	$62\overline{)12424}$
5.	$48\overline{)2708}$	$42\overline{)8412}$	$53\overline{)10605}$	$72\overline{)2909}$	$81\overline{)16201}$
6.	$56\overline{)2807}$	$25\overline{)15128}$	$36\overline{)21814}$	$28\overline{)14128}$	$49\overline{)34343}$

DIVISION TEST I

1. $75\overline{)2800}$ **2.** $37\overline{)15133}$ **3.** $50\overline{)1971}$ **4.** $75\overline{)4513}$

5. $38\overline{)19266}$ **6.** $95\overline{)3870}$ **7.** $79\overline{)47716}$ **8.** $86\overline{)3574}$

DIVISION TEST II

1. $27\overline{)8109}$ **2.** $36\overline{)3610}$ **3.** $24\overline{)9602}$ **4.** $23\overline{)9629}$

5. $97\overline{)9777}$ **6.** $85\overline{)8585}$ **7.** $49\overline{)98196}$ **8.** $45\overline{)7654}$

Zeros are important

Read these numbers. Your teacher will then dictate them to see if you can write them.

	a	b	c	d
1.	1,000,000	1,110,000	1,100,100	10,100,010
2.	1,100,001	100,000	1,001,001	10,000,001
3.	1,100,010	1,010,000	10,010,010	10,010,100

Subtract and check:

	a	b	c	d	e
4.	2864 1764	5607 3865	8679 5045	500 289	2846 1756
5.	906 784	6794 5604	2000 1864	700 527	3124 1999

Multiply, and check by going over your work:

	a	b	c	d	e
6.	280 37	800 725	864 60	863 4000	345 7000
7.	506 84	783 208	289 500	475 3000	879 7000

8. Multiply each of these numbers by 100: 56 75 287 354

Where will you write the first quotient figure in each division? Estimate each quotient. Then divide and check.

	a	b	c	d	e
9.	7)1421	8)165	21)426	21)4263	35)10503
10.	9)3618	8)2407	35)7040	35)7039	35)6901
11.	29)5800	29)5830	29)5857	29)5859	29)5986
12.	43)1320	43)1362	43)1710	43)3430	43)3860

All aboard!

1. Look at Russell's timetable below. When does the train leave Philadelphia?

Do you know whether that is 10:27 A.M. or 10:27 P.M.? (All A.M. time is printed in light figures and all P.M. time in heavy figures.)

2. At what stations does the train stop? At what time does the train leave each of these stations?

3. Find the number of minutes the train takes to go from each station to the next station.

4. How long does it take to go from Philadelphia to Washington?

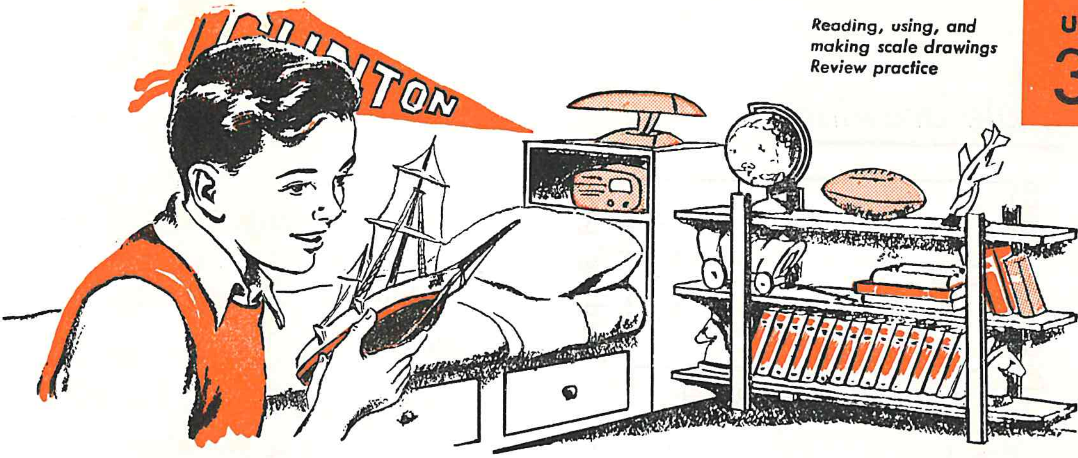
5. How long does the train take to go from:
  Wilmington to Baltimore?
  Chester to Washington?
  Perryville to Baltimore?

6. Find the number of miles between each station and the next station to it.

7. How many miles is it from:
  Wilmington to Baltimore?
  Baltimore to Washington?
  Elkton to Washington?

8. When the train arrived in Washington yesterday, the station clock read 1:23. Was the train on time? Was it late?

Miles	Table 9	Daily
.....	Lv **Philadelphia, Pa.**	10:27
13	Lv Chester, Pa.	10:45
27	Lv Wilmington, Del.	11:02
43	Lv Elkton, Md.	11:20
59	Lv Perryville, Md.	11:38
60	Lv Havre de Grace, Md.	11:43
95	Ar **Baltimore, Md.**	**12:20**
135	Ar **Washington, D. C.**	**1:10**



Using plans in craftwork

Jimmy found in a magazine some plans for making bookshelves. Study the plans below and answer these questions:

1. How long are the shelves?

2. How many shelf boards are needed? How many uprights?

3. The bottom shelf is ? inches from the floor.

4. Each shelf is ? in. high.

5. The uprights are ? in. high.

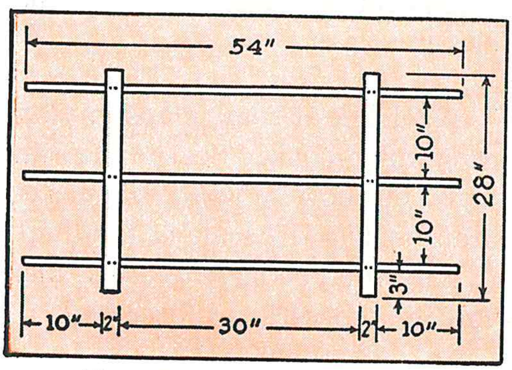
6. The uprights are placed ? inches from the ends of the shelves.

7. How tall a book could you stand in the second shelf of the bookshelves? on the bottom shelf?

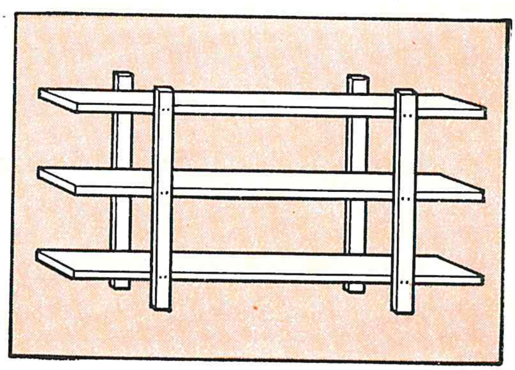
8. Do you understand the plans well enough to make the bookshelves?

9. Have you ever used a printed plan for building or making anything? What were you making?

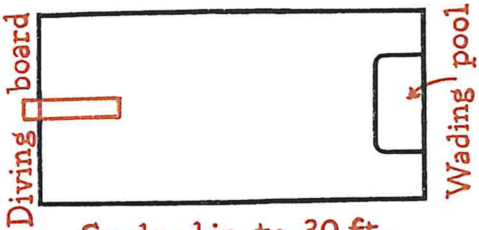
Can you bring what you made, and the plans for making it, to school for the class to see?



Plans for bookshelves


Finished bookshelves

Scale drawings



Scale: 1 in. to 30 ft.

Jim drew this sketch of the new swimming pool at Woodland Park.

In Jim's drawing 1 inch stands for 30 feet at the pool. We say he used a ***scale*** of 1 inch to 30 feet.

1. Use your ruler to find out how long Jim's drawing of the pool is.

If 1 in. on the drawing equals 30 ft., then 2 in. = _?_ ft.

The pool is _?_ ft. long.

2. How wide is the drawing of the pool? How wide is the pool?

Lines *a* to *e* below are drawn to a scale of $\frac{1}{4}$ inch to a foot.

a ———
b ————
c —————
d ———————
e ——————————

3. Line *a* is _?_ fourths of an inch long. It stands for _?_ feet.

4. Line *b* is _?_ fourths of an inch long. It stands for _?_ feet.

5. Line *c* is _?_ fourths of an inch long. It stands for _?_ feet.

6. Line *d* is _?_ fourths of an inch long. It stands for _?_ feet.

7. Line *e* is _?_ fourths of an inch long. It stands for _?_ feet.

8. Use a scale of $\frac{1}{2}$ inch to a foot. How long a line stands for 2 feet? 3 feet? 4 feet? 5 feet?

9. Use a scale of $\frac{1}{10}$ inch to a foot. How long a distance does 1 inch stand for? $\frac{1}{2}$ inch? 2 inches? $2\frac{1}{2}$ inches?

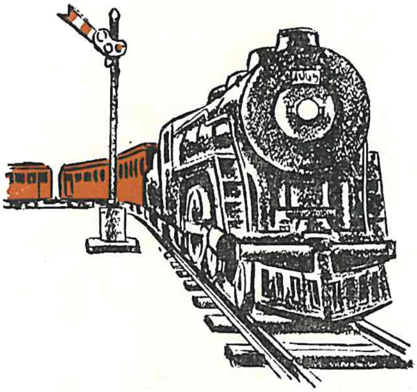
10. Use a scale of 1 inch to 20 feet. How long a distance does $\frac{1}{2}$ inch stand for? 2 inches? $2\frac{1}{2}$ inches?

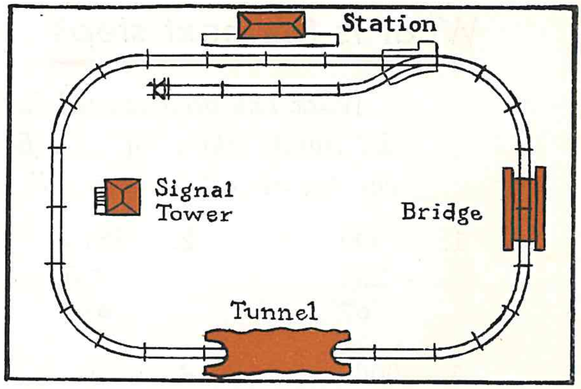
11. Use a scale of 1 inch to 100 miles. How long a distance does $\frac{1}{2}$ inch stand for? 2 inches? $1\frac{1}{2}$ inches? 10 inches?

In a ***scale drawing*** of any object an inch or a fraction of an inch stands for a longer length in the object.

12. Look at some maps in your geography book. See if you can figure out how far apart two places are by using the scale of the map.

Why will you have to use a ruler to help you with this exercise?





Scale: 1 in. to 3 ft.

Scale drawings

1. Above is a scale drawing of the platform Billy built for his electric train.

What scale did he use on the drawing?

2. How long is the platform? How wide?

3. How long is the tunnel?

4. Model airplanes made for the army or the navy are built on the scale 1 in. to 6 ft.

This means that 1 in. on the model represents 6 ft., or _?_ in., on the real airplane.

5. Use the scale 1 in. to 6 ft. Draw a line to represent 3 ft.; 12 ft.; 36 ft.

6. Use the scale 1 in. to 1 mi. Make a scale drawing of a farm 1 mi. long and $\frac{1}{2}$ mi. wide.

7. The wing span of one American airplane is 96 ft. How long a line will represent this wing span if you use:

- a scale 1 in. to 6 ft.?
- a scale 1 in. to 8 ft.?
- a scale 1 in. to 12 ft.?

8. A cornfield is 100 ft. wide and 300 ft. long. Make a scale drawing of the field, using the scale 1 in. to 100 ft.

9. Use the scale $\frac{1}{2}$ in. to a yard. Draw a line that represents 1 yd.; 2 yd.; 3 yd.; 4 yd.; 5 yd.

10. Use the scale $\frac{3}{4}$ in. to a mile. Draw a line that represents 1 mile; 2 miles; 3 miles; $\frac{1}{2}$ mile.

11. Use the scale $\frac{1}{4}$ in. to a mile. Draw a line that represents 1 mile; 2 miles; 3 miles; 4 miles; 8 miles.

What is the next step?

Work has been started in Exs. 1–18. In each example a dot stands where the next figure is to be placed. See if you can tell what that figure will be. Do not use a pencil.

1. $\begin{array}{r} 900 \\ -\ 293 \\ \hline \bullet 7 \end{array}$ **2.** $\begin{array}{r} 2815 \\ -\ 935 \\ \hline \bullet 80 \end{array}$ **3.** $\begin{array}{r} 504 \\ -\ 64 \\ \hline \bullet 0 \end{array}$ **4.** $\begin{array}{r} 200\frac{1}{2} \\ -\ 36 \\ \hline \bullet\frac{1}{2} \end{array}$

5. $\begin{array}{r} 906 \\ \times\ 84 \\ \hline \bullet 4 \end{array}$ **6.** $\begin{array}{r} 540 \\ \times\ \ 60 \\ \hline \bullet 0 \end{array}$ **7.** $\begin{array}{r} 7\frac{1}{4} \\ -\ 2\frac{3}{4} \\ \hline \bullet\frac{1}{2} \end{array}$ **8.** $\begin{array}{r} 5\frac{1}{4} \\ +\ 3\frac{7}{8} \\ \hline \bullet\frac{1}{8} \end{array}$

9. $\begin{array}{r} 528 \\ 52 \\ 300 \\ +\ 220 \\ \hline \bullet 0 \end{array}$ **10.** $\begin{array}{r} 639 \\ \times\ 207 \\ \hline 4473 \\ \bullet\ \ \end{array}$ **11.** $\begin{array}{r} 2\bullet \\ 43\overline{)873} \\ 86 \\ \hline 13 \end{array}$ **12.** $\begin{array}{r} 6\bullet \\ 49\overline{)3410} \\ 294 \\ \hline 470 \end{array}$

13. $\begin{array}{r} 7 \\ 27\overline{)1967} \\ 189 \\ \hline \bullet 7 \end{array}$ **14.** $\begin{array}{r} 3 \\ 35\overline{)10502} \\ 105 \\ \hline \bullet \end{array}$ **15.** $\begin{array}{r} 3\frac{1}{2} \\ +\ 2\frac{3}{4} \\ \hline 6\frac{\bullet}{4} \end{array}$ **16.** $\begin{array}{r} 3\frac{1}{12} \\ +\ 7\frac{1}{8} \\ \hline \frac{5}{\bullet} \end{array}$

17. $\frac{5}{6} + \frac{5}{6} = 1\frac{\bullet}{3}$ **18.** $\frac{1}{3} + \frac{1}{6} + \frac{1}{4} = \frac{3}{\bullet}$

19. Now copy and finish Exs. 1–18.

Just for Fun

1. Which would be worth more, a pound of silver dollars, or four pounds of silver quarters?

2. Can you find these interesting multiplication answers without using a pencil?

35 × 10,101 425 × 1,001

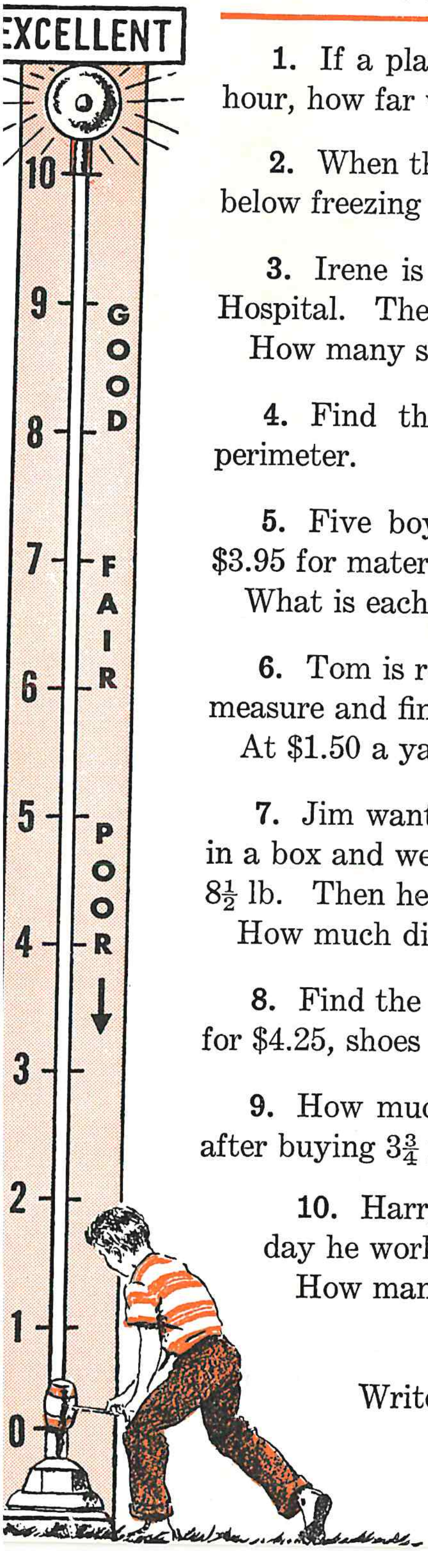
3. A ranger has 9 pieces of chain. The lengths are 1 ft., 2 ft., 3 ft., etc. up to 9 ft.

How shall he join the pieces so that he will then have 3 pieces of equal length?

4. Write 30 using three 5's.

5. Write 48 using four 6's.

Problem Test 7



1. If a plane travels at a steady speed of 280 miles an hour, how far will it go in $\frac{3}{4}$ hour?

2. When the thermometer reads 18°, how many degrees below freezing is it?

3. Irene is going to knit a lap robe for the Children's Hospital. The robe is to be 8 squares long and 6 wide.
How many squares must Ann knit?

4. Find the area of a rectangle $5' \times 9'$. Find the perimeter.

5. Five boys are building a radio. They have spent \$3.95 for materials.
What is each boy's share of the expense?

6. Tom is repairing his tent. He measured with a tape measure and finds he needs 90 inches of new canvas.
At \$1.50 a yard, how much will the canvas cost?

7. Jim wanted to weigh his puppy. He put the puppy in a box and weighed the box and puppy. The weight was $8\frac{1}{2}$ lb. Then he weighed the box. It weighed $\frac{3}{4}$ lb.
How much did the puppy weigh?

8. Find the total cost of a tennis racket for \$3.19, a net for \$4.25, shoes for \$1.19, and 3 balls at 39¢ each.

9. How much change will you get from a 5-dollar bill after buying $3\frac{3}{4}$ yd. of material at \$.36 a yard?

10. Harry worked $3\frac{3}{4}$ hours on Monday. On Tuesday he worked $3\frac{1}{6}$ hours.
How many hours did Harry work in all?

Write your score on your Problem Test Record.

Are you a quick thinker?

Tell the missing numbers:

	a	b	c
1.	1 sq. ft. $= \underline{\ ?\ }$ sq. in.	$\frac{1}{4}$ ft. $= \underline{\ ?\ }$ in.	$\frac{3}{4} = \frac{?}{8}$
2.	$\frac{1}{2}$ sq. ft. $= \underline{\ ?\ }$ sq. in.	$\frac{1}{6}$ ft. $= \underline{\ ?\ }$ in.	$\frac{2}{5} = \frac{?}{10}$
3.	2 sq. ft. $= \underline{\ ?\ }$ sq. in.	$\frac{5}{6}$ ft. $= \underline{\ ?\ }$ in.	$\frac{1}{3} + \frac{1}{6} = \underline{\ ?\ }$
4.	1 sq. yd. $= \underline{\ ?\ }$ sq. ft.	$\frac{1}{3}$ yd. $= \underline{\ ?\ }$ ft.	$\frac{1}{2} + \frac{1}{3} = \underline{\ ?\ }$
5.	$\frac{1}{3}$ sq. yd. $= \underline{\ ?\ }$ sq. ft.	$\frac{1}{2}$ yd. $= \underline{\ ?\ }$ in.	$\frac{1}{2} - \frac{1}{10} = \underline{\ ?\ }$
6.	27 sq. ft. $= \underline{\ ?\ }$ sq. yd.	$\frac{1}{6}$ yd. $= \underline{\ ?\ }$ in.	$4 - 2\frac{1}{4} = \underline{\ ?\ }$
7.	54 sq. ft. $= \underline{\ ?\ }$ sq. yd.	$\frac{5}{6}$ yd. $= \underline{\ ?\ }$ in.	$5\frac{1}{3} - 3 = \underline{\ ?\ }$
8.	$1\frac{1}{2}$ sq. ft. $= \underline{\ ?\ }$ sq. in.	$\frac{1}{2}$ mi. $= \underline{\ ?\ }$ ft.	$4\frac{1}{2} - \frac{2}{3} = \underline{\ ?\ }$

	a	b	c	d	e	f
9.	$\begin{array}{r} 16 \\ +\ 27 \\ \hline \end{array}$	$\begin{array}{r} 417 \\ +\ 12 \\ \hline \end{array}$	$\begin{array}{r} 285 \\ +\ 930 \\ \hline \end{array}$	$\begin{array}{r} 754 \\ -\ 62 \\ \hline \end{array}$	$\begin{array}{r} 900 \\ -\ 276 \\ \hline \end{array}$	$\begin{array}{r} 897 \\ -\ 128 \\ \hline \end{array}$

10. Multiply 809 by 9; by 8; by 7; by 6; by 5.

11. Divide 847 by 9; by 8; by 7; by 6; by 5.

Give the whole-number part of each quotient:

	a	b	c	d	e
12.	$40\overline{)207}$	$30\overline{)216}$	$20\overline{)98}$	$21\overline{)197}$	$29\overline{)197}$
13.	$38\overline{)156}$	$42\overline{)257}$	$56\overline{)389}$	$79\overline{)276}$	$84\overline{)675}$
14.	$99\overline{)876}$	$87\overline{)635}$	$79\overline{)624}$	$65\overline{)479}$	$58\overline{)442}$
15.	$47\overline{)385}$	$39\overline{)276}$	$47\overline{)358}$	$59\overline{)275}$	$67\overline{)384}$
16.	$28\overline{)165}$	$37\overline{)264}$	$57\overline{)403}$	$69\overline{)600}$	$88\overline{)720}$

Think hard!

1. Is $10 - 8\frac{1}{6}$ more than 2 or less than 2?

2. Change to mixed numbers and reduce fractions to lowest terms:

$\frac{14}{4}$ $\frac{33}{6}$ $\frac{25}{10}$ $\frac{40}{12}$ $\frac{34}{8}$

3. Show that 23×15 is equal to 20×15, plus 3×15.

4. Draw a rectangle 3″ by 4″. Draw lines inside the rectangle to show that its area is 12 sq. in.

5. Make a scale drawing of a rectangle 24′ by 36′, using a scale of 1″ to 12′.

6. Tom's average daily grade in arithmetic one week (5 days) was 90. Four of his daily grades were 96, 94, 85, and 75. Can you find the missing grade?

7. From a roll of tar paper containing $6\frac{1}{4}$ yards, Bill cut off a piece $1\frac{1}{3}$ yd. long. How much was left?

8. Find the cost of a rug 9′ by 12′, at $4.50 a square yard.

9. Is $16\frac{7}{8} - 11\frac{1}{4}$ more than 5 or less than 5?

10. Is the quotient in $25\overline{)20350}$ more than 1000? more than 100? more than 800? Do the division.

11. Is the quotient in $58\overline{)607}$ more than 10? more than 100? Do the division.

12. Is the quotient in $37\overline{)7581}$ more than 10? more than 100? more than 200? more than 300? Do the division.

13. Tom read that the cost of a certain kind of silver-plated metal is about 10 cents a square inch. He said, "At the same rate that's __?__ a square foot."

14. Which number below is a sensible answer to $38\overline{)2470}$?

605 65 85 850 650

Copy and work:

15. $\begin{array}{r} 78 \\ 349 \\ 74 \\ 738 \\ \underline{196} \end{array}$

16. $\begin{array}{r} 467 \\ 842 \\ 958 \\ 472 \\ \underline{687} \end{array}$

17. $\begin{array}{r} 12578 \\ \underline{-\ 3897} \end{array}$

18. $\begin{array}{r} \$70.00 \\ \underline{-\ 25.75} \end{array}$

19. $\begin{array}{r} 24\frac{3}{4} \\ \underline{+\ 16\frac{2}{3}} \end{array}$

20. $\begin{array}{r} 6087 \\ \underline{\times\ 307} \end{array}$

21. $\begin{array}{r} 307 \\ \underline{\times\ 500} \end{array}$

22. $\begin{array}{r} 468 \\ \underline{\times\ 79} \end{array}$

UNIT 31

Meaning of decimals (tenths and hundredths). Adding and subtracting tenths and hundredths

(Optional)

Using decimals — tenths

At the automobile dealer's, Burt and his father got into their brand-new car to drive it home.

"The mileage marker is set at 0," said his father. "We'll find out exactly how many miles it is from here to our house."

Burt did not look at the mileage marker again until the car stopped at the first traffic light. When he looked then, he saw this:

"Dad!" exclaimed Burt, "the marker isn't working right. It shows 5 miles and I know it couldn't be more than $\frac{1}{2}$ mile from the car dealer's to this corner."

"The marker is all right," laughed his father. "The blue numbers do not tell miles, but *tenths* of miles. The 5 means *5 tenths* mile, or $\frac{1}{2}$ mile. $\frac{5}{10} = \frac{1}{2}$.

"Watch the marker closely now and see how the numbers change."

Burt watched carefully. As the numbers changed, he read, "6 tenths, 7 tenths, 8 tenths, and 9 tenths." Then 0 appeared in the tenths-of-a-mile place and a 1 appeared in the whole-number-of-miles place:

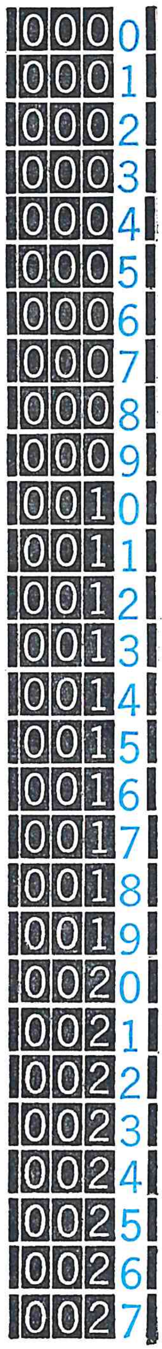
"I see," said Burt. "10 tenths of a mile equal 1 whole mile." He continued to count as the numbers changed, "1 and 1 tenth, 1 and 2 tenths, 1 and 3 tenths, 1 and 4 tenths, 1 and 5 tenths," and so on.

Read the numbers shown on the scale as Burt did. Say *and* between the whole number and the tenths.

There are two ways of writing the fractions Burt was reading. They can be written as a common fraction or as a ***decimal fraction***. Both ways are shown below.

A number that contains a decimal fraction is usually called a ***decimal***, for short.

COMMON FRACTION:	$\frac{7}{10}$	$\frac{8}{10}$	$\frac{9}{10}$	$\frac{10}{10}$	$1\frac{1}{10}$	$1\frac{2}{10}$
DECIMAL:	.7	.8	.9	1.0	1.1	1.2



To the Teacher: See Note 7 on page 310.

The dot in .7 is called the ***decimal point.*** $\frac{7}{10}$ and .7 mean the same. Both are read the same way. One and four tenths may be written as $1\frac{4}{10}$ or as 1.4.

Read these and tell the missing numbers:

1. .7 .8 _?_ 1.0 _?_ 1.2 _?_

2. 1.7 1.8 _?_ _?_ 2.1 2.2

3. 2.8 2.9 _?_ 3.1 3.2 _?_ 3.4 _?_ _?_

4. 1.6 1.5 _?_ _?_ 1.2 _?_ 1.0 _?_ _?_

5. 3.4 3.2 _?_ _?_ 2.6 2.4 _?_ _?_ 1.8

6. 6.5 7.0 _?_ 8.0 _?_ _?_ 9.5 _?_ _?_

7. 8.5 8.0 7.5 _?_ _?_ _?_ 5.5 _?_ _?_

8. Write each of these numbers in two ways:

nine tenths	one and six tenths
one tenth	ten and five tenths

9. Count by 2 tenths from 2.6 to 4.2; from 6.8 back to 4.8. Write the numbers in two ways.

10. When Burt and his father got home, Burt looked at the mileage marker and said, "We have traveled 11 and 7 tenths miles." Write this, using a decimal point.

Now write a decimal showing how far they had gone after they traveled .2 mile more; .3 mile more; 1 mile more; 1.1 miles more.

11. Jim's teacher has a ruler like the one at the bottom of the page. Each inch is divided into 10 equal parts. Each small unit is .1 of an inch long.

Point to the small units and count from .1 inch to 4 inches. Can you think of several different ways to count?

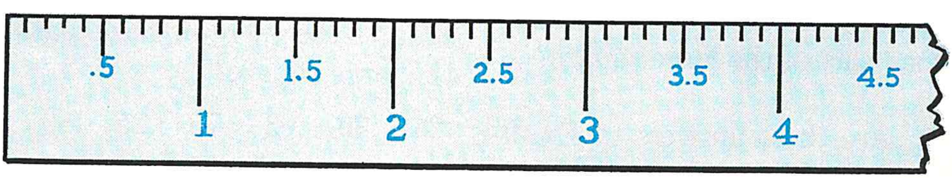
12. Point to the .5-inch mark; to the $\frac{5}{10}$-inch mark; to the $\frac{1}{2}$-inch mark.

Does $.5 = \frac{5}{10} = \frac{1}{2}$?

13. Show that:

$1.5 = 1\frac{1}{2}$ $\quad 2.5 = 2\frac{1}{2}$ $\quad 3.5 = 3\frac{1}{2}$

14. Show that .2 more than 1.8 is 2; that .4 more than 2.6 is 3; that 1.3 more than .7 is 2.



Using decimals — hundredths

1. You have learned two ways of writing tenths. There are also two ways of writing hundredths:

COMMON FRACTION:	$\frac{12}{100}$	$\frac{5}{100}$	$\frac{85}{100}$	$3\frac{1}{100}$	$4\frac{10}{100}$
DECIMAL:	.12	.05	.85	3.01	4.10

How many places are there after the decimal point in hundredths?

Read these decimal numbers:

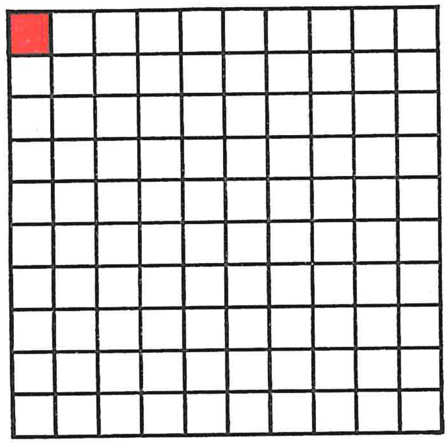
	a	*b*	*c*	*d*	*e*	*f*	*g*
2.	.2	.4	.7	.05	.07	.09	.24
3.	1.2	1.0	3.04	7.09	8.14	9.83	1.75

Tell the missing numbers:

4. .01 .02 .03 _?_ .05 .06 _?_ .08

5. .97 .98 .99 _?_ 1.01 1.02 _?_ 1.04

6. .25 _?_ .23 .22 _?_ .20 .19 .18



7. The large square at the right is divided into _?_ equal parts. The small colored square is what part of the large square? Write your answer in two ways.

8. What part of the whole square is 3 small squares? 12? 15? 37? 50? 75? 100? Write each answer in two ways.

9. How many rows of small squares are there in the large square? One row of small squares is what part of the large square?

10. Are these answers to Ex. 9 correct? $\frac{10}{100}$ .10 $\frac{1}{10}$ .1

11. What part of the large square is 2 rows of squares? 3 rows? 4 rows? 5 rows? 6 rows? 7? 8? 9? Write each answer in at least 4 ways.

12. How many rows of small squares and how many extra squares are there in these parts of the large square?

.24	.30	.03	.75	.25	.80	.08
.42	.68	.86	.93	.39	.16	.61

Measuring by tenths and hundredths

1. George saw his father put a measuring stick like this down into an oil tank. His father pulled out the stick and looked at the fresh oil mark on it. "The tank is only one tenth full," he said.

Notice the oil mark and the two ways one tenth is written on the measuring stick.

2. Use a strip of paper to show how far up the oil will come on the stick when the tank is .2 full; .4 full; .8 full; entirely full.

3. George said, "The stick is marked off into 100 small parts. I could use it to measure the oil when the tank is only .01 full." Prove that George is right.

4. Use a strip of paper to show how far up the oil will come on the stick when the tank is:

.05 full	.12 full	.25 full	.49 full	.60 full
.75 full	.90 full	.09 full	.80 full	.8 full

Use the square on page 270 to show the number truths in Exs. 5–12 below. Then show the number truths again on the measuring stick at the right.

5. $.5 = \frac{5}{10} = \frac{1}{2}$

6. $.20 = .2 = \frac{2}{10} = \frac{1}{5}$

7. $.25 = \frac{25}{100} = \frac{1}{4}$

8. $.75 = \frac{75}{100} = \frac{3}{4}$

9. $.80 = .8 = \frac{8}{10}$

10. $\frac{7}{10} = .7 = .70$

11. 1 whole = 10 tenths = 100 hundredths

12. $\frac{1}{2}$ = 5 tenths = 50 hundredths

13. On another day George measured the oil in the tank. The tank was .2 full. After 100 gallons of oil were put into it, George measured again. The tank was .7 full.

George said, "Those 100 gallons filled .5 or $\frac{1}{2}$ of this tank. The tank must hold 200 gallons." Prove that he is right.

United States money and decimals

1. One dollar = ? cents. What coin represents $\frac{1}{100}$ of a dollar?

$\frac{1}{100}$ of a dollar may be written \$.01 or 1¢.

2. What part of a dollar is \$.02? \$.03? \$.04? \$.05? \$.10?

3. \$.17 means $\frac{17}{100}$ of a dollar. What fraction of a dollar is \$.21? \$.35? \$.69? \$.83? \$.98? \$.20?

4. You can read \$2.34 in two ways:

- two dollars and thirty-four cents
- two and 34 hundredths dollars

Read each of these in two ways:

\$3.49 \$2.08 \$12.10 \$1.01 \$0.24

5. One dollar = ? dimes. What coin represents $\frac{1}{10}$ of a dollar?

$\frac{1}{10}$ of a dollar may be written \$.10 or 10¢.

Tom was thinking about the cents point used in writing money.

"In \$2.19," he said, "the cents point is really a decimal point. The 2 stands for 2 whole dollars; the 1 stands for 1 dime, or 1 *tenth* of a dollar; and the 9 stands for 9 cents, or 9 *hundredths* of a dollar."

6. What would Tom say each figure stands for in these numbers?

\$2.35 \$0.48 \$1.40 \$3.04

7. Tom says, "When I think of \$2.35 as 2 dollar bills and 35 pennies, I think of it as 2 and 35 hundredths dollars.

"But when I think of \$2.35 as 2 dollar bills, 3 dimes, and 5 pennies, I think of it as 2 dollars, ? tenths of a dollar, and ? hundredths of a dollar."

8. In "\$1.11" the 1 at the left of the decimal point stands for 1 whole dollar.

What does the first 1 at the right of the decimal point stand for? the second 1 at the right of the decimal point?

9. Using dollar sign and cents point, write:

- 3 dollars, 4 tenths of a dollar, and 7 hundredths of a dollar
- 2 and 16 hundredths dollars
- 1 and 10 hundredths dollars
- 5 and 5 hundredths dollars
- 5 and 5 tenths dollars
- 6 and 3 tenths dollars

10. Sue said, "Ones, tenths, hundredths make me think of dollars, ? , ? ."

Writing decimals

Write these common fractions as decimals:

	a	b	c	d	e	f	g
1.	$\frac{2}{10}$	$\frac{3}{10}$	$\frac{7}{10}$	$\frac{8}{10}$	$\frac{9}{10}$	$\frac{4}{10}$	$\frac{6}{10}$
2.	$\frac{3}{100}$	$\frac{4}{100}$	$\frac{5}{100}$	$\frac{6}{100}$	$\frac{2}{100}$	$\frac{7}{100}$	$\frac{8}{100}$
3.	$\frac{13}{100}$	$\frac{25}{100}$	$\frac{18}{100}$	$\frac{32}{100}$	$\frac{45}{100}$	$\frac{83}{100}$	$\frac{50}{100}$
4.	$1\frac{6}{10}$	$2\frac{13}{100}$	$4\frac{5}{100}$	$5\frac{8}{10}$	$14\frac{24}{100}$	$7\frac{9}{10}$	$9\frac{14}{100}$

Write these decimals as common fractions or mixed numbers:

5.	.6	.8	.9	.03	.09	.13	.75
6.	1.2	1.7	2.04	5.13	6.75	8.98	7.22

7. Write the following numbers as decimals:

Eighteen and five tenths
Five and twenty-five hundredths
Twenty-two and two tenths
Ten and eight hundredths

8. Brad has a sheet of 100 Christmas seals. Write a decimal to show what part of the seals he tears off when he tears off 5 seals; 10 seals; 25 seals; 50 seals.

9. Brad says that 10 seals are .10 of the 100 seals. Bob says that 10 seals are .1 of the seals. Prove that both boys are right.
Does $\frac{10}{100} = \frac{1}{10}$? Does .10 = .1?

10. Some metal plates are .2 inch thick. How many such plates laid on each other would it take to make an inch?

Where should the decimal point be placed in these numbers to make sensible sentences?

11. Boots cost $475 a pair.

12. Henry's new baseball mitt cost $650.

13. Mary weighs 895 pounds.

14. John's shoes are 105 inches long.

15. Mary paid $65 for a dozen eggs.

Adding decimals

Tom	Jane
$4\frac{6}{10}$	4.6
$4\frac{6}{10}$	4.6
$4\frac{6}{10}$	4.6
$4\frac{6}{10}$	4.6
$16\frac{24}{10} = 18\frac{4}{10}$	18.4

1. Miss Barry said, "Find the perimeter of a square that is four and 6 tenths inches on each side."

Here is the way two pupils solved the problem. Explain the work of each. Did they get the same answer? Whose solution do you like better? Why?

In two ways find the sum of:

2. Three and 3 tenths + four and 4 tenths

3. Six and 18 hundredths + twelve and 5 hundredths

4. Ten and 5 tenths + seven and 6 tenths

5. Twenty and 15 hundredths + thirty and 85 hundredths

Find an item in Column **b** *to match each item in Column* **a**:

6.

a	*b*
$5\frac{5}{10}$	.5 + .5 + .5
$\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$	5.5
.5	.50

7.

a	*b*
$8\frac{1}{2}$	$\frac{85}{100} + \frac{85}{100}$
.85 + .85	$\frac{85}{100}$
.85	8.5

Add and check:

8.	**9.**	**10.**	**11.**
54.8′	1.36″	5.68 yd.	14.2 mi.
13.4′	5.83″	4.32 yd.	25.8 mi.
28.9′	7.14″	6.14 yd.	68.5 mi.

12. Check Jean's addition of 1.30 + .40 + .69:

1.30
.40
.69
2.39

Add and check:

13.	**14.**	**15.**	**16.**
6.90	7.20	8.75	.98
.40	1.05	1.60	1.07
1.78	.97	.94	8.50

17. 2.00 + .02 **18.** .30 + .30 + .40 **19.** 1.00 + .10 + .01

Subtracting decimals

1. Elaine and Tommy heard a radio announcer say, "The world's record for running the 100-yard dash is 9 and 4 tenths seconds."

Tommy said, "My record in the 100-yard dash is fourteen and 6 tenths seconds."

Then Elaine and Tommy both found how much longer it took Tommy to run 100 yards than it took the holder of the world's record.

Explain the work of each. Did they get the same answer? Whose solution do you like better? Why?

Elaine

$$\begin{array}{r} 14\frac{6}{10}\text{ sec.} \\ -\ 9\frac{4}{10}\text{ sec.} \\ \hline 5\frac{2}{10}\text{ sec.} \end{array}$$

Tommy

$$\begin{array}{r} 14.6\text{ sec.} \\ -\ 9.4\text{ sec.} \\ \hline 5.2\text{ sec.} \end{array}$$

In two ways find these differences:

2. Twenty-eight and 7 tenths − five and 3 tenths

3. Thirty-two and 9 tenths − seven and 4 tenths

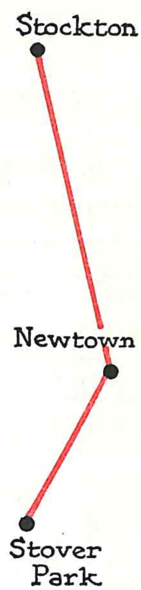
4. Twenty-three and 2 tenths − six and 7 tenths

5. Forty-seven − twenty-four and 3 tenths

6. Thirty-eight and 6 tenths − 5 tenths

7. Forty-five and 7 tenths − twenty-three

8. Look at the map at the right. The distance from Stockton to Stover Park is 35.4 miles. The distance from Newtown to Stover Park is 11.9 miles. How far is it from Stockton to Newtown?



9. The average rainfall in Phoenix, Arizona, is 7.81 inches in a year. The average rainfall in Boston, Massachusetts, is 40.77 inches in a year. How many more inches of rain fall in Boston than in Phoenix during an average year?

Subtract and check:

10. $\begin{array}{r} 28.6 \\ \underline{16.4} \end{array}$ **11.** $\begin{array}{r} 2.79 \\ \underline{1.45} \end{array}$ **12.** $\begin{array}{r} 4.12 \\ \underline{1.58} \end{array}$ **13.** $\begin{array}{r} 54.05 \\ \underline{8.16} \end{array}$ **14.** $\begin{array}{r} 75.70 \\ \underline{8.09} \end{array}$

Self-Help Test 18

1. How many thousand-dollar bills does it take to make a million dollars? **(1)**

2. Write the Arabic numerals for CCLXXXIV. **(205)**

3. Find the sum:
$4.1 + 5.2 + 6.0$ **(274)**

4. At 3 for 10¢, how many pears can you buy for 30¢? **(176–177)**

5. At 3 for 10¢, how much will a dozen pears cost? **(176–177)**

6. Elizabeth has embroidered a bedspread that is 99 inches long and 81 inches wide. She wants to buy some fringe to put around the edge of it.

How many inches of fringe will she need for the spread? How many yards? **(161)**

Self-Help Test 19

1. $37\overline{)2110}$ **(196)** **2.** $68\overline{)13608}$ **(258)**

3. $37\overline{)4334}$ **(174)** **4.** $52\overline{)\$78.00}$ **(192)**

5. At 15¢ each, how many party favors can May buy for \$1.75? How much money will she have left? **(193)**

6. How many hours are there in 320 min.? Reduce the fraction in the answer. **(219)**

7. The average of 260 mi., 310 mi., 264 mi., 175 mi., and 184 mi. is _?_ mi. **(257)**

8. If he drives at an average speed of 38 mi. an hour, how long should a driver allow for a trip of 152 mi.? **(127–128)**

9. Find the area of a rectangle 28 ft. by 8 ft. **(248)**

10. A square 3 ft. on each side contains _?_ sq. yd. **(249)**

11. How much seed will be needed for 2 grass plots each 40 ft. × 20 ft., if 1 lb. of seed is enough for 200 sq. ft.? **(245–246)**

12. The average January temperature in Atlanta, Georgia, is 43.4 degrees. The average January temperature in Madison, Wisconsin, is 17.5 degrees.

How many degrees colder is it on the average during the month of January in Madison than it is in Atlanta? **(275)**

Self-Help Test 20

1. $\begin{array}{r} \frac{2}{7} \\ \underline{+\frac{3}{7}} \end{array}$ (136)

2. $\begin{array}{r} \frac{3}{5} \\ \underline{+\frac{1}{10}} \end{array}$ (145)

3. $\begin{array}{r} \frac{2}{3} \\ \underline{+\frac{7}{9}} \end{array}$ (145)

4. $\begin{array}{r} \frac{3}{5} \\ \underline{+\frac{1}{4}} \end{array}$ (215)

5. $\begin{array}{r} \frac{3}{12} \\ \underline{+\frac{1}{2}} \end{array}$ (148)

6. $\begin{array}{r} 5\frac{5}{8} \\ \underline{+4\frac{3}{16}} \end{array}$ (151)

7. $\begin{array}{r} 5\frac{1}{6} \\ \underline{+7\frac{1}{3}} \end{array}$ (217)

8. $\begin{array}{r} 7\frac{4}{5} \\ \underline{+6\frac{3}{10}} \end{array}$ (218)

9. $\begin{array}{r} 4\frac{7}{12} \\ \underline{+3\frac{7}{12}} \end{array}$ (223)

10. $\begin{array}{r} 2\frac{4}{5} \\ \underline{+5\frac{7}{10}} \end{array}$ (223)

11. How many square inches are there in a game board that measures 18″ by 20″? (247)

12. 8 sq. yd. = __?__ sq. ft.; 18 sq. ft. = __?__ sq. yd. (249)

13. If $\frac{1}{2}$″ represents 1 mile, 2″ represent __?__ miles. (263–264)

14. If $\frac{1}{4}$″ on a map represents 100 miles, then 1″ represents __?__ miles. (263–264)

Self-Help Test 21

1. $\begin{array}{r} \frac{5}{6} \\ \underline{-\frac{4}{6}} \end{array}$ (136)

2. $\begin{array}{r} \frac{5}{6} \\ \underline{-\frac{2}{3}} \end{array}$ (146)

3. $\begin{array}{r} \frac{7}{10} \\ \underline{-\frac{1}{5}} \end{array}$ (148)

4. $\begin{array}{r} \frac{3}{4} \\ \underline{-\frac{1}{3}} \end{array}$ (215)

5. $\begin{array}{r} 7\frac{3}{4} \\ \underline{-3\frac{1}{6}} \end{array}$ (152)

6. $\begin{array}{r} 4\frac{5}{8} \\ \underline{-\frac{1}{2}} \end{array}$ (152)

7. $\begin{array}{r} 4\frac{1}{6} \\ \underline{-\frac{5}{6}} \end{array}$ (233)

8. $\begin{array}{r} 5\frac{1}{10} \\ \underline{-\frac{2}{5}} \end{array}$ (234)

9. $\begin{array}{r} 4\frac{1}{3} \\ \underline{-\frac{3}{4}} \end{array}$ (234)

10. $\begin{array}{r} 9\frac{1}{4} \\ \underline{-3\frac{1}{3}} \end{array}$ (235)

11. $\begin{array}{r} 7\frac{3}{10} \\ \underline{-5\frac{3}{5}} \end{array}$ (235)

12. $\begin{array}{r} 6\frac{5}{8} \\ \underline{-5\frac{3}{4}} \end{array}$ (235)

13. $1 - \frac{5}{6} =$ __?__. Make a drawing to prove your answer. (232)

14. $4 - \frac{3}{8} =$ __?__. Make a drawing to prove your answer. (232)

15. $2\frac{1}{3} - \frac{7}{3} =$ __?__. Make a drawing to prove your answer. (105)

16. $\frac{4}{8} - \frac{2}{4} =$ __?__. Make a drawing to prove your answer. (45)

17. $\frac{10}{4} =$ __?__. Make a drawing to prove your answer. (43)

Measuring your growth in arithmetic

Work carefully. Check your answers. Be sure your answers are sensible.

1. The sum of 1.86, 3.20, and 2.65 is _?_.

2. Write in decimal form:

$\frac{4}{10}$ $\frac{4}{100}$ $\frac{25}{100}$ $2\frac{3}{10}$ $3\frac{17}{100}$

3. The average of 7, 9, 15, 20, and 47 is _?_.

4. A bus takes from 11:42 A.M. to 12:22 P.M. to make the trip from Midland to Woodside. The trip takes _?_ min.

5. Divide 52003 by 65.

6. Drawn to a scale of $\frac{1}{2}$ in. to 1 mi., a line 2 in. long represents a distance of _?_ mi.

7. Using a scale of 1 in. to 100 ft., draw a line to represent 300 ft.

8. The area of a rectangle 8″ by 15″ is _?_ square inches.

9. $\frac{1}{2}$ sq. ft. = _?_ sq. in.
$\frac{1}{2}$ sq. yd. = _?_ sq. ft.

10. A fifth-grade class has a pair of guinea pigs. The pupils have 18 ft. of wire netting to enclose a pen for them.

Bob said they could enclose a pen 6′ by 3′. Dick said the pen would be larger if they made it 5′ by 4′. Draw a diagram of each of the pens.

- The perimeter of each pen would be _?_ ft.
- The area of Bob's pen would be _?_ sq. ft.
- The area of Dick's pen would be _?_ sq. ft.
- Whose pen would be larger?

Just for fun

Ask someone to:

- take any 2-digit number.
- add up the digits.
- subtract this sum from the original number.
- cross out any one digit in the sum (but not a zero).

You then ask what digit is left. By subtracting this from 9 you can tell your friend the digit he crossed out.

Now take a 3-digit number. Try to find a way to figure out the crossed-out digit.

Multiplying whole numbers and fractions, and whole numbers and mixed numbers

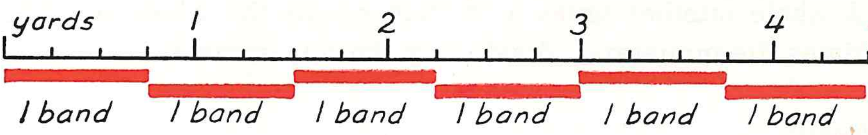
UNIT 32

A whole number times a fraction

Six girls in Miss Lane's class are going to wear ribbon headbands in the Maypole dance.

① Connie thought, "For 1 headband we'll need $\frac{3}{4}$ of a yard. So for 6 headbands we'll need $6 \times \frac{3}{4}$ of a yard.

Then she drew this diagram and found that they would need $\frac{18}{4}$ of a yard, or $4\frac{1}{2}$ yards. Explain her diagram.



② Jane said, "I don't need a diagram to find how much ribbon we need. I just do this addition:

$$\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}=\frac{18}{4}=4\frac{2}{4}=4\frac{1}{2}.$$

"We need $4\frac{1}{2}$ yd. This is a sensible answer. $\frac{3}{4}$ yd. is less than 1 yd. So six of the $\frac{3}{4}$ yards is less than 6 yd."

③ Alice said, "To find how many yards of ribbon we need, I multiply $\frac{3}{4}$ yd. by 6. 6×3 fourths $= 18$ fourths $= 4\frac{2}{4} = 4\frac{1}{2}$."

"I write it this way: $6 \times \frac{3}{4} = \frac{6 \times 3}{4} = \frac{18}{4} = 4\frac{2}{4} = 4\frac{1}{2}$."

Show how Connie, Jane, and Alice would find how many yards of ribbon are needed for 4 bands; 5 bands.

Tell the missing numbers. Be sure each answer is sensible.

1. $\begin{cases} 6 \times 3 \text{ fourths} = \underline{\ ?\ } \text{ fourths} \\ 6 \times \frac{3}{4} = \frac{6 \times 3}{4} = \frac{?}{4} = \underline{\ ?\ } \end{cases}$

2. $\begin{cases} 10 \times 2 \text{ fifths} = \underline{\ ?\ } \text{ fifths} \\ 10 \times \frac{2}{5} = \frac{10 \times 2}{5} = \frac{?}{5} = \underline{\ ?\ } \end{cases}$

3. $\begin{cases} 6 \times 1 \text{ half} = \underline{\ ?\ } \text{ halves} \\ 6 \times \frac{1}{2} = \frac{6 \times 1}{2} = \frac{?}{2} = \underline{\ ?\ } \end{cases}$

4. $\begin{cases} 12 \times 2 \text{ thirds} = \underline{\ ?\ } \text{ thirds} \\ 12 \times \frac{2}{3} = \frac{12 \times 2}{3} = \frac{?}{?} = \underline{\ ?\ } \end{cases}$

5. $\begin{cases} 8 \times 2 \text{ thirds} = \underline{\ ?\ } \text{ thirds} \\ 8 \times \frac{2}{3} = \frac{8 \times 2}{3} = \frac{?}{?} = \underline{\ ?\ } \end{cases}$

6. $\begin{cases} 20 \times 4 \text{ fifths} = \underline{\ ?\ } \text{ fifths} \\ 20 \times \frac{4}{5} = \frac{20 \times 4}{5} = \frac{?}{?} = \underline{\ ?\ } \end{cases}$

A whole number times a fraction

1. George dug 6 baskets of potatoes. Each basket held $\frac{3}{8}$ bu. To find how many bushels he dug, he did the work in the box. What rule was he using?

$$6 \times \frac{3}{8} = \frac{6 \times 3}{8} = \frac{18}{8} = 2\frac{1}{4}$$

(Ans. $2\frac{1}{4}$ bu.)

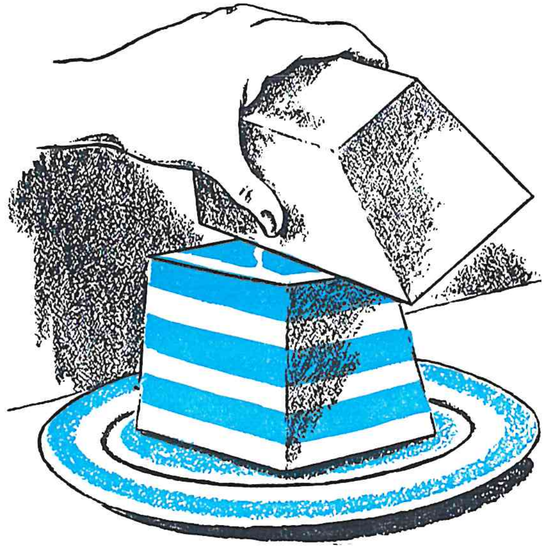
2. George (Ex. 1) had made the rule below. Is it a good one?

> **A whole number times a fraction equals the whole number times the numerator, divided by the denominator.**

Multiply:

	a	*b*	*c*	*d*	*e*
3.	$3 \times \frac{4}{5}$	$2 \times \frac{3}{4}$	$6 \times \frac{2}{3}$	$4 \times \frac{2}{5}$	$12 \times \frac{1}{4}$
4.	$4 \times \frac{2}{3}$	$3 \times \frac{2}{5}$	$8 \times \frac{5}{6}$	$8 \times \frac{4}{6}$	$12 \times \frac{3}{8}$
5.	$6 \times \frac{3}{5}$	$4 \times \frac{7}{8}$	$9 \times \frac{5}{6}$	$10 \times \frac{5}{8}$	$12 \times \frac{5}{8}$
6.	$8 \times \frac{3}{8}$	$6 \times \frac{5}{8}$	$7 \times \frac{3}{8}$	$12 \times \frac{5}{6}$	$12 \times \frac{7}{8}$
7.	$10 \times \frac{4}{5}$	$8 \times \frac{3}{4}$	$8 \times \frac{5}{12}$	$16 \times \frac{3}{8}$	$12 \times \frac{9}{8}$

8. Kit is making a grape-cheese gelatin salad like the one at the right. Each layer is $\frac{3}{4}''$ thick. Will a pan $4''$ high be tall enough to hold 6 layers?



9. Peter is drawing a map. On his map $\frac{5}{8}$ in. represents 1 mi. How long a line will represent 3 mi.? 5 mi.? 8 mi.?

10. Ellen practices her music three quarters of an hour every day. How many hours does she practice in a week? in 30 days?

A whole number times a mixed number

1. Jean is to buy cloth for three pink dresses to be worn in the Maypole dance. Each dress requires $4\frac{3}{4}$ yards. How much cloth should she buy?

Can you find $3 \times 4\frac{3}{4}$ yards? Try it before reading further.

Jean did it this way:

$3 \times \frac{3}{4}$ yd. $= \frac{9}{4}$ yd. $= 2\frac{1}{4}$ yd.
3×4 yd. $= 12$ whole yards
12 yd. $+ 2\frac{1}{4}$ yd. $= 14\frac{1}{4}$ yd.

She decided she would need to buy $14\frac{1}{4}$ yards. Was she right?

When you multiply $4\frac{3}{4}$ by 3, you will find it easier to write the example this way:⟶

$$\begin{array}{r} 4\frac{3}{4} \\ \times\ 3 \\ \hline 2\frac{1}{4} \\ 12 \\ \hline 14\frac{1}{4} \end{array}$$

▶ Think, "$3 \times \frac{3}{4} = \frac{9}{4} = 2\frac{1}{4}$." Write the $2\frac{1}{4}$.

▶ Then think, "$3 \times 4 = 12$." Write the 12 and add.

How does your solution differ from Jean's solution above? How is it like Jean's solution? Are the answers in the two solutions alike?

Is $14\frac{1}{4}$ a reasonable answer? Think, "3×4 yd. would not be enough; 3×5 yd. would be too much. It should be more than _?_ yd. but less than _?_ yd. Is it?"

2. Five third-grade girls will be flower girls on May Day. Each girl will wear a white dress that will require $2\frac{2}{3}$ yards of cheesecloth. How many yards will be required for the 5 dresses?

Before looking at the work in the box, estimate the answer. Will as much as 5×2 yards be needed? as much as 5×3 yards? To be reasonable, must the answer be more than 10 yards but less than 15 yards?

Multiply as shown in the box at the right.

$$\begin{array}{r} 2\frac{2}{3} \\ \times\ 5 \\ \hline 3\frac{1}{3} \\ 10 \\ \hline 13\frac{1}{3} \end{array}$$

▶ Think, "$5 \times \frac{2}{3} = \frac{10}{3} = 3\frac{1}{3}$." Write the $3\frac{1}{3}$.

▶ Then think, "$5 \times 2 = 10$." Write the 10 and add.

This shows that $5 \times 2\frac{2}{3} = 13\frac{1}{3}$. Is that a reasonable answer?

3. How many yards of ribbon will be needed to decorate six May baskets if $1\frac{3}{4}$ yd. is needed for each?

$$\begin{array}{r} 1\frac{3}{4} \\ \times\ 6 \\ \hline 4\frac{1}{2} \\ 6 \\ \hline 10\frac{1}{2} \end{array}$$

First estimate the answer. Will as much as 6 yd. be needed? as much as 12 yd.?

Explain the multiplication in the box. Is $10\frac{1}{2}$ a reasonable answer?

Streamers for the Maypole dance

Explain these multiplication examples. Then copy the examples and solve them without looking at the book. When you have finished, compare your solutions with those given.

1. $\begin{array}{r} 8\frac{1}{2} \\ \times\ 6 \\ \hline 3 \\ 48 \\ \hline 51 \end{array}$ **2.** $\begin{array}{r} 2\frac{3}{4} \\ \times\ 8 \\ \hline 6 \\ 16 \\ \hline 22 \end{array}$ **3.** $\begin{array}{r} 4\frac{2}{3} \\ \times\ 9 \\ \hline 6 \\ 36 \\ \hline 42 \end{array}$ **4.** $\begin{array}{r} 7\frac{1}{3} \\ \times\ 7 \\ \hline 2\frac{1}{3} \\ 49 \\ \hline 51\frac{1}{3} \end{array}$ **5.** $\begin{array}{r} 10\frac{7}{8} \\ \times\ 9 \\ \hline 7\frac{7}{8} \\ 90 \\ \hline 97\frac{7}{8} \end{array}$

Estimate these products. (Will the first answer be more than 5? as much as 10? closer to 10 than to 5?) Then do the multiplications.

	a	*b*	*c*	*d*	*e*
6.	$5 \times 1\frac{7}{8}$	$7 \times 2\frac{3}{4}$	$6 \times 3\frac{2}{5}$	$8 \times 12\frac{1}{2}$	$6 \times 16\frac{2}{3}$
7.	$6 \times 3\frac{3}{4}$	$6 \times 3\frac{1}{2}$	$6 \times 3\frac{7}{8}$	$6 \times 3\frac{3}{8}$	$6 \times 3\frac{15}{16}$
8.	$2 \times 13\frac{1}{3}$	$2 \times 13\frac{1}{4}$	$2 \times 13\frac{1}{2}$	$2 \times 13\frac{5}{6}$	$2 \times 13\frac{2}{3}$
9.	$4 \times 24\frac{1}{6}$	$4 \times 24\frac{1}{8}$	$4 \times 24\frac{1}{3}$	$4 \times 24\frac{5}{6}$	$4 \times 24\frac{1}{2}$
10.	$6 \times 16\frac{1}{4}$	$5 \times 16\frac{2}{3}$	$4 \times 12\frac{1}{2}$	$3 \times 33\frac{2}{3}$	$3 \times 33\frac{1}{3}$
11.	$4 \times 32\frac{1}{2}$	$3 \times 23\frac{1}{3}$	$6 \times 31\frac{2}{3}$	$5 \times 13\frac{1}{3}$	$8 \times 21\frac{1}{4}$
12.	$8 \times 24\frac{1}{8}$	$4 \times 48\frac{1}{4}$	$6 \times 16\frac{1}{8}$	$4 \times 26\frac{2}{5}$	$5 \times 42\frac{1}{4}$
13.	$4 \times 32\frac{3}{4}$	$8 \times 15\frac{1}{4}$	$9 \times 44\frac{5}{6}$	$7 \times 13\frac{2}{3}$	$9 \times 67\frac{7}{8}$

14. Miss Beck's class is going to make the streamers for a Maypole dance. Each streamer will be $5\frac{3}{4}$ yd. long.

How many yards of ribbon will be needed to make 6 green streamers? (How much is $6 \times \frac{3}{4}$? How much is 6×5? Then how much is $6 \times 5\frac{3}{4}$?)

15. How many yards of ribbon will be needed to make 3 yellow streamers each $5\frac{3}{4}$ yd. long? 4 white streamers? 5 orange streamers?

16. Dan needs $1\frac{2}{3}$ yd. of mosquito netting to screen each of 4 windows. How many yards does he need for the 4 windows?

After-school problems

Estimate each answer. Then solve the problem.

1. Ray is going to put new electric cord in 3 floor lamps for his mother. He needs $14\frac{1}{2}$ ft. of cord for each lamp.

How many feet of cord does he need for the 3 lamps?

2. Tom wants to build a bookcase between his desk and his bed. The shelves can be $2\frac{3}{4}'$ long. He has a board 12′ long.

From this board can he cut 3 shelves? 4 shelves? 5 shelves?

3. Jim works in his garden $1\frac{3}{4}$ hours a day. How many hours does he work in 2 days? in 3 days? 4? 5? 6? 7?

4. Gilbert earns $\$2\frac{1}{2}$ a week running errands after school. How much will he earn in 3 weeks? in 4 weeks? 5? 6? 7?

How many weeks will it take Gilbert to earn $5? $10? $15? $20? $25?

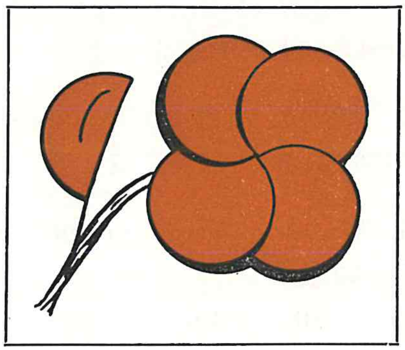
5. Betty Jean is making a bed cover. She is knitting blocks $4\frac{1}{4}$ in. wide and $6\frac{1}{2}$ in. long. She plans to make the cover 8 blocks wide and 8 blocks long.

How many inches wide will her cover be? How many inches long?

6. Draw a full-sized diagram of Betty Jean's bed cover (Ex. 5) on the blackboard.

Draw the lines that mark off the blocks. How many blocks will she need to knit?

7. How many inches wide and long will Betty Jean's cover be if she makes it 9 blocks wide and 9 blocks long?



8. Louise is making flower placecards for a party. She uses $4\frac{1}{2}$ circles for each card.

How many circles does she need for 4 cards? 8 cards? 9 cards? 12 cards?

9. Judy is making gingham curtains for the kitchen. It takes $1\frac{7}{8}$ yd. of gingham for 1 pair of curtains.

How many yards will Judy need to make 4 pairs the same size?

Practice in thinking

1. Which of these numbers are equal to $3\frac{1}{2}$?

$\frac{7}{2}$ 3.5 $3\frac{5}{100}$ $3\frac{5}{10}$ 3.50 3.05

2. John says that .59 means $\frac{50}{100} + \frac{9}{100}$. Is he right?

Tell in the same way what these mean: .65 .23 .86 .75

3. \$1.76 means \$1.00 + \$.70 + \$.06. Tell in the same way what these mean: \$2.64 \$4.98 \$7.35

4. Which of these fractions is largest? $\frac{1}{5}$ $\frac{1}{3}$ $\frac{1}{4}$ $\frac{1}{2}$

5. Which of these fractions is smaller than 1? $\frac{5}{4}$ $\frac{4}{4}$ $\frac{4}{5}$ $\frac{5}{5}$

6. Which of these numbers are equal to $\frac{1}{10}$?

.01 .10 1.0 $\frac{10}{100}$ .1

7. At 10¢ a square foot, the cost of cleaning a 9′ × 12′ rug is a little _?_ than \$11.00.

8. A pansy plant needs a square foot of space to grow well. A square yard of space would be enough for _?_ plants.

9. Tom gave this puzzle to his class: "I am thinking of a square. Its perimeter is 40. What is its area?" Can you tell?

10. At 35¢ a dozen, the cost of 1 orange is a little _?_ than 3¢.

11. Is the quotient in $85\overline{)3010}$ more than 10? more than 100? less than 40?

12. Is the quotient in $63\overline{)2450}$ more than 10? more than 100? less than 40?

13. Is the quotient in $78\overline{)15904}$ more than 10? more than 100? less than 200?

14. Bill had 60¢; Joe had 90¢. Bill said, "Joe, if you give me _?_ cents, we'll each have the same amount."

15. The average of 5, 7, 9, 10, and 9 is _?_.

If the 10 had been a zero, the average would have been _?_.

16. If it takes $\frac{5}{6}$ yd. of toweling for 1 towel, then for 6 towels would it take 6 yd., or more than 6 yd., or less than 6 yd.?

17. How much larger or smaller than $\frac{1}{2}$ is each of these?

$\frac{3}{8}$ $\frac{5}{16}$ $\frac{5}{12}$ $\frac{5}{8}$ $\frac{15}{32}$ $\frac{1}{3}$ $\frac{11}{24}$

18. Tell which are equal to $\frac{1}{2}$:

.5 $\frac{6}{12}$ $\frac{12}{16}$ $\frac{8}{16}$ .50 .05 $\frac{50}{100}$

A fraction times a whole number

Larry picks raspberries for his Uncle Jim. He gets $\frac{3}{8}$ of the berries he picks.

One day he picked 16 qt. How many quarts belonged to him as his share?

Larry thought, "$\frac{1}{8}$ of 16 qt. is 2 qt.; so $\frac{3}{8}$ of 16 qt. is 3×2 qt., or 6 qt." He kept 6 qt. Was that right?

1. What is $\frac{3}{4}$ of 24? Think, "$\frac{1}{4}$ of 24 is 6; so $\frac{3}{4}$ of 24 is 3×6, or _?_."

2. What is $\frac{3}{8}$ of 32? Think, "$\frac{1}{8}$ of 32 is 4; so $\frac{3}{8}$ of 32 is $3 \times$ _?_, or _?_."

3. What is $\frac{3}{8}$ of 40? $\frac{4}{5}$ of 20? $\frac{2}{3}$ of 36? $\frac{7}{8}$ of 16?

4. Find the cost of $\frac{3}{4}$ lb. of nails at 24¢ a pound.

5. In $\frac{3}{4}$ yd. there are _?_ in.

6. In $\frac{3}{4}$ lb. there are _?_ oz.

7. In $\frac{3}{4}$ hr. there are _?_ min.

8. In $\frac{3}{4}$ dollar there are _?_¢.

9. In $\frac{3}{4}$ ft. there are _?_ in.

10. In $\frac{3}{4}$ doz. there are _?_ things.

11. In $\frac{3}{4}$ mi. there are _?_ ft.

12. In $\frac{3}{4}$ ton there are _?_ lb.

Judy makes jelly from the berries her brother Larry picks. He has given her enough berries to make $\frac{2}{3}$ of the recipe.

The recipe calls for 5 cups of sugar. How much sugar should she use? Can you find $\frac{2}{3}$ of 5? Try it before reading farther.

① Judy thought, "$\frac{1}{3}$ of $5 = 1\frac{2}{3}$; so $\frac{2}{3}$ of $5 = 2 \times 1\frac{2}{3}$, or $3\frac{1}{3}$. I shall need $3\frac{1}{3}$ cups of sugar." Was that right?

② Judy's mother said, "I like to think of it this way. I know that $\frac{1}{3}$ of 5 is $\frac{5}{3}$. So $\frac{2}{3}$ of 5 is $2 \times \frac{5}{3}$, or $\frac{10}{3}$. I write the solution this way:

$$\frac{2}{3} \text{ of } 5 = \frac{2 \times 5}{3} = \frac{10}{3} = 3\frac{1}{3}.\text{"}$$

13. Find $\frac{2}{3}$ of 7, using Judy's mother's method. Find $\frac{2}{3}$ of 7, using Judy's method. Which way seems easier to you?

14. Find $\frac{3}{4}$ of 9, using Judy's mother's method. Find $\frac{3}{4}$ of 9, using Judy's method. Which way seems easier to you?

15. In two different ways find the cost of $\frac{7}{8}$ lb. of candied fruit at 54¢ a pound.

16. In two ways find the cost of $\frac{3}{4}$ lb. of fudge at 27¢ a pound.

Finding a part of a number

Larry and Ellen wanted to find $\frac{3}{4}$ of 15. Each found the answer in a different way. Whose way is easier?

LARRY'S WAY: $\frac{1}{4}$ of $15 = 3\frac{3}{4}$ $\quad \frac{3}{4}$ of $15 = 3 \times 3\frac{3}{4} = 11\frac{1}{4}$

ELLEN'S WAY: $\frac{3}{4}$ of $15 = \frac{3 \times 15}{4} = \frac{45}{4} = 11\frac{1}{4}$

Work these examples both ways and tell which way is easier in each example:

	a	b	c	d	e
1.	$\frac{5}{8}$ of 24	$\frac{2}{3}$ of 5	$\frac{5}{6}$ of 18	$\frac{3}{4}$ of 9	$\frac{2}{5}$ of 8
2.	$\frac{2}{3}$ of 18	$\frac{3}{5}$ of 10	$\frac{7}{8}$ of 27	$\frac{3}{5}$ of 25	$\frac{3}{8}$ of 40
3.	$\frac{2}{5}$ of 20	$\frac{3}{4}$ of 16	$\frac{3}{8}$ of 32	$\frac{4}{5}$ of 9	$\frac{2}{7}$ of 21
4.	$\frac{3}{4}$ of 13	$\frac{5}{6}$ of 13	$\frac{4}{5}$ of 30	$\frac{5}{8}$ of 12	$\frac{2}{3}$ of 27

Choose the easier way to solve these problems:

5. Claire wants to buy $\frac{3}{4}$ yard of ribbon at 18¢ a yard. She thought, "$\frac{3}{4}$ of 18¢ $= \frac{54}{4} = 13\frac{1}{2}$¢. I'll have to pay 14¢."

Was Claire right? Explain her thinking.

6. At 25¢ a yard, how much will $\frac{3}{4}$ yard of gingham cost?

7. Find the cost of $\frac{3}{8}$ yard of muslin at 22¢ a yard.

8. Hilda's mother needs $\frac{5}{8}$ yard of nylon at \$2.45 a yard. How much will she have to pay?

9. What is the cost of $\frac{2}{3}$ yard of linen at 79¢ a yard?

"$\frac{2}{3}$ of 5" is often written "$\frac{2}{3} \times 5$."

Find:

	a	b	c
10.	$\frac{2}{3} \times 21$	$\frac{4}{5} \times 40$	$\frac{5}{8} \times 12$
11.	$\frac{5}{6} \times 10$	$\frac{7}{8} \times 12$	$\frac{3}{5} \times 20$
12.	$\frac{3}{8} \times 64$	$\frac{8}{9} \times 27$	$\frac{3}{8} \times 20$
13.	$\frac{3}{4} \times 13$	$\frac{4}{5} \times 21$	$\frac{2}{5} \times 14$

You know that $5 \times 10 = 10 \times 5$. Show that:

	a	b
14.	$5 \times \frac{2}{3} = \frac{2}{3} \times 5$	$\frac{7}{8} \times 40 = 40 \times \frac{7}{8}$
15.	$6 \times \frac{2}{5} = \frac{2}{5} \times 6$	$\frac{5}{6} \times 36 = 36 \times \frac{5}{6}$
16.	$\frac{2}{3} \times 8 = 8 \times \frac{2}{3}$	$9 \times \frac{3}{8} = \frac{3}{8} \times 9$

A mixed number times a whole number

1. Patrick figured the cost of $6\frac{3}{8}$ lb. of fish at 40¢ a pound this way:

- $\frac{3}{8}$ lb. costs $\frac{3}{8} \times 40$¢, or ___?___¢
- 6 lb. cost 6×40¢, or ___?___
- $6\frac{3}{8}$ lb. cost 15¢ + \$2.40, or ___?___

2. Patrick (Ex. 1) could have written his work this way:⟶

$$\begin{array}{r} \$.40 \\ 6\frac{3}{8} \\ \hline .15 \\ 2.40 \\ \hline \$2.55 \end{array}$$

Where does the 15 cents come from? the \$2.40? the \$2.55?

3. Find the cost of $4\frac{5}{8}$ lb. of fish at \$.40 a pound.

4. What is the cost of a $3\frac{3}{4}$-lb. chicken at 48 cents a pound?

5. The cost of a $12\frac{1}{2}$-lb. turkey at 48 cents a pound is ___?___.

6. The cost of $3\frac{3}{4}$ yd. of rope at 16¢ a yard is ___?___.

7. Find the cost of $3\frac{3}{8}$ bu. of peaches at \$4.00 a bushel.

Copy Exs. 8–11 without the work. Then multiply and compare your work with the work shown below.

8.	**9.**	**10.**	**11.**
$\begin{array}{r} 36 \\ \times 4\frac{2}{3} \\ \hline 24 \\ 144 \\ \hline 168 \end{array}$	$\begin{array}{r} 56 \\ \times 5\frac{3}{8} \\ \hline 21 \\ 280 \\ \hline 301 \end{array}$	$\begin{array}{r} 60 \\ \times 8\frac{3}{4} \\ \hline 45 \\ 480 \\ \hline 525 \end{array}$	$\begin{array}{r} 30 \\ \times 6\frac{3}{10} \\ \hline 9 \\ 180 \\ \hline 189 \end{array}$

Find these products:

	a	b	c	d
12.	$2\frac{2}{3} \times 15$	$2\frac{7}{8} \times 40$	$1\frac{5}{16} \times 32$	$3\frac{3}{4} \times 24$
13.	$2\frac{5}{8} \times 32$	$3\frac{3}{4} \times 60$	$2\frac{5}{12} \times 36$	$3\frac{5}{8} \times 48$
14.	$3\frac{4}{5} \times 30$	$8\frac{3}{8} \times 16$	$4\frac{3}{10} \times 20$	$5\frac{5}{8} \times 16$

15. Is the product of $4\frac{3}{4} \times 32$ closer to 128 or to 160? How can you tell?

16. Is $4\frac{7}{8} \times 40$ a little more or a little less than 200? How can you tell?

17. Is $5\frac{6}{7} \times 21$ a little more or a little less than 126? How can you tell?

18. Ellen estimates that $3\frac{3}{8} \times$ \$1.20 is \$4.00. Her estimate is off by ___?___ cents.

A mixed number times a whole number

1. This is how Sue estimated the cost of a $5\frac{3}{4}$-lb. veal roast at 63¢ a pound:

$\frac{1}{4}$ lb. costs about 16 cents; $\frac{3}{4}$ lb. costs about 50 cents. 5 lb. cost about \$3. So $5\frac{3}{4}$ lb. cost about ___?___.

2. To find the exact cost of the $5\frac{3}{4}$ lb. of veal roast (Ex. 1), the butcher did this figuring:⟶

$$\begin{array}{r} \$.63 \\ \times\ 5\frac{3}{4} \\ \hline 4)\overline{\$1.89} \\ \hline .47\frac{1}{4} \\ 3.15 \\ \hline \$3.62\frac{1}{4} \end{array}$$

Explain how the butcher found $\frac{3}{4}$ of \$.63. How much did he charge?

3. Estimate the cost of $4\frac{3}{4}$ lb. of beef at 80 cents a pound, and then try to find the exact cost.

Copy Exs. 4–7 without the work. Then multiply, and compare your work with the book.

4.
$$\begin{array}{r} 51 \\ \times\ 3\frac{3}{4} \\ \hline 4)\overline{153} \\ \hline 38\frac{1}{4} \\ 153 \\ \hline 191\frac{1}{4} \end{array}$$

5.
$$\begin{array}{r} 15 \\ \times\ 4\frac{5}{8} \\ \hline 8)\overline{75} \\ \hline 9\frac{3}{8} \\ 60 \\ \hline 69\frac{3}{8} \end{array}$$

6.
$$\begin{array}{r} 21 \\ \times\ 6\frac{7}{8} \\ \hline 8)\overline{147} \\ \hline 18\frac{3}{8} \\ 126 \\ \hline 144\frac{3}{8} \end{array}$$

7.
$$\begin{array}{r} 25 \\ \times\ 8\frac{2}{3} \\ \hline 3)\overline{50} \\ \hline 16\frac{2}{3} \\ 200 \\ \hline 216\frac{2}{3} \end{array}$$

8. To estimate the product of $2\frac{3}{4} \times 15$, think:

- ▶ $\frac{1}{4}$ of 15 is about ___?___.
- ▶ $\frac{3}{4}$ of 15 is about ___?___.
- ▶ 2×15 is ___?___.
- ▶ So $2\frac{3}{4} \times 15$ is about ___?___.

Now find the exact product, and compare your estimate with it.

Estimate each of these products. Then find how close each estimate is to the exact product.

9.	$3\frac{3}{4} \times 21$	$4\frac{2}{3} \times 17$
10.	$4\frac{2}{5} \times 26$	$2\frac{5}{8} \times 33$
11.	$5\frac{3}{5} \times 12$	$4\frac{5}{6} \times 23$
12.	$3\frac{2}{3} \times 31$	$4\frac{7}{8} \times 17$

13. How much does Jeff earn in $4\frac{3}{4}$ hr. at 35¢ an hour?

14. When cauliflower sells for 14¢ a pound, a head weighing 2 lb. 4 oz. will cost ___?___¢.

15. Mary went to the butcher shop to buy a roast. The butcher showed her a $4\frac{3}{4}$-lb. piece priced at 67 cents a pound.

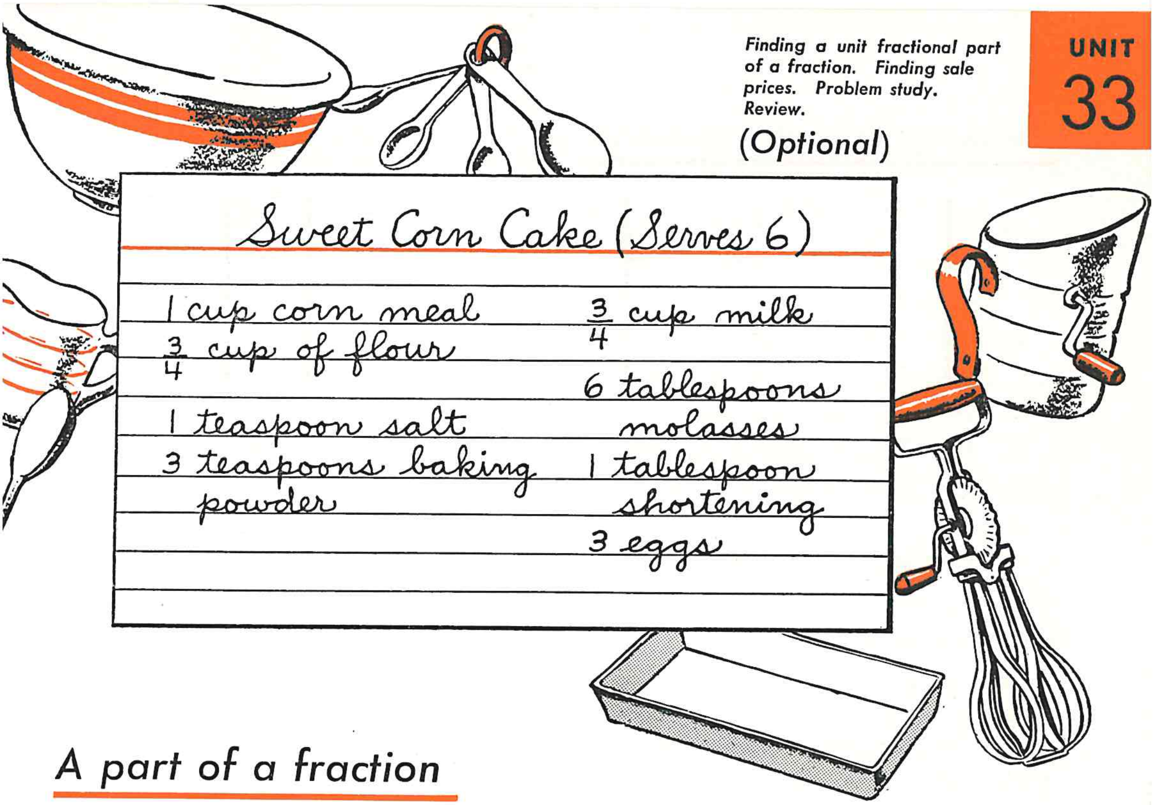
Mary quickly estimated the cost to be 5×65¢, or \$3.25. The butcher said, "This piece will cost you ___?___."

How close was Mary's estimate?

Finding a unit fractional part of a fraction. Finding sale prices. Problem study. Review.

(Optional)

UNIT 33



A part of a fraction

1. Sue is making some sweet corn cake for herself and Polly.

She said, "This recipe makes enough for _?_ persons.

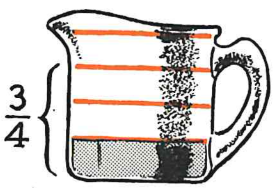
"For 2 of us, I'll make only $\frac{2}{6}$, or $\frac{1}{3}$, of the recipe."

Was Sue correct?

2. Sue measured out $\frac{1}{3}$ cup of corn meal. Was that correct?

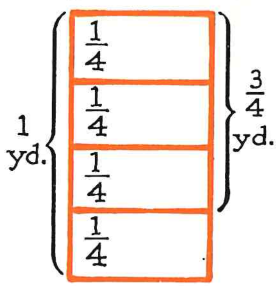
3. Sue thought, "How shall I measure $\frac{1}{3}$ of $\frac{3}{4}$ of a cup of flour?

"I see. $\frac{1}{3}$ of 3 *dollars* is 1 *dollar*. So $\frac{1}{3}$ of 3 *fourths* is 1 *fourth*. I'll use $\frac{1}{4}$ cup of flour." Do you agree?



4. How much of each of the other things did Sue use in her corn cake?

5. Use this diagram to show that if you cut $\frac{3}{4}$ yd. of material into 3 equal parts, there will be $\frac{1}{4}$ yd. in each part.



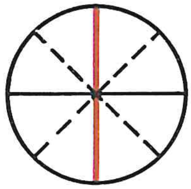
6. Ex. 5 proves that $\frac{1}{3}$ of 3 fourths = _?_ fourth.

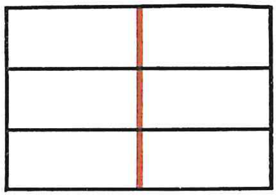
$\frac{1}{3}$ of $\frac{3}{4}$ = _?_.

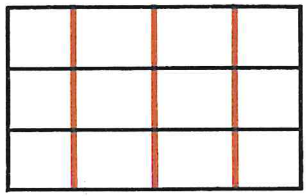
7. If three children share equally $\frac{3}{4}$ lb. of candy, each will get _?_ of a pound.

To the Teacher: See Note 7, page 310.

Thinking about fractions







1. The brown line in Circle A divides the circle into ___?___.

2. The brown line and the black line together in Circle A divide the circle into ___?___.

3. The brown line, the black line, and the dotted lines together divide the circle into ___?___.

4. Point to $\frac{1}{2}$ of Circle A. Now point to $\frac{1}{2}$ of $\frac{1}{2}$.
Show that $\frac{1}{2}$ of $\frac{1}{2} = \frac{1}{4}$.

5. Point to $\frac{1}{4}$ of Circle A. Now point to $\frac{1}{2}$ of $\frac{1}{4}$.
Show that $\frac{1}{2}$ of $\frac{1}{4} = \frac{1}{8}$.

6. Point to $\frac{1}{2}$ of Circle A. Now point to $\frac{1}{4}$ of $\frac{1}{2}$.
Show that $\frac{1}{4}$ of $\frac{1}{2} = \frac{1}{8}$.

7. In Rectangle B the brown line divides the rectangle into ___?___.
The black lines divide the rectangle into ___?___.

8. The brown line and the black lines together divide Rectangle B into ___?___.

9. Point to $\frac{1}{3}$ of Rectangle B. Now point to $\frac{1}{2}$ of $\frac{1}{3}$.
Show that $\frac{1}{2}$ of $\frac{1}{3} = \frac{1}{6}$.

10. Point to $\frac{1}{2}$ of Rectangle B. Now point to $\frac{1}{3}$ of $\frac{1}{2}$.
Show that $\frac{1}{3}$ of $\frac{1}{2} = \frac{1}{6}$.

11. Point to $\frac{2}{3}$ of Rectangle B. Now point to $\frac{1}{2}$ of $\frac{2}{3}$.
Show that $\frac{1}{2}$ of $\frac{2}{3} = \frac{1}{3}$.

12. In Rectangle C the brown lines divide the rectangle into ___?___.
The black lines divide the rectangle into ___?___.

13. The brown and the black lines together divide Rectangle C into ___?___.

14. Point to $\frac{1}{3}$ of Rectangle C. Now point to $\frac{1}{4}$ of $\frac{1}{3}$.
Show that $\frac{1}{4}$ of $\frac{1}{3} = \frac{1}{12}$.

15. Point to $\frac{1}{4}$ of Rectangle C. Now point to $\frac{1}{3}$ of $\frac{1}{4}$.
Show that $\frac{1}{3}$ of $\frac{1}{4} = \frac{1}{12}$.

16. Use Rectangle C to show that $\frac{2}{12} = \frac{1}{6}$.

Thinking about measures

What numbers belong in these blank spaces?

	a	*b*	*c*
1.	3 in. = $\underline{\;?\;}$ ft.	$\frac{1}{2}$ lb. = $\underline{\;?\;}$ oz.	$\frac{1}{2}$ gal. = $\underline{\;?\;}$ qt.
2.	2 ft. = $\underline{\;?\;}$ yd.	4 oz. = $\underline{\;?\;}$ lb.	1 qt. = $\underline{\;?\;}$ gal.
3.	$\frac{1}{2}$ ton = $\underline{\;?\;}$ lb.	.5 gal. = $\underline{\;?\;}$ qt.	6 qt. = $\underline{\;?\;}$ gal.
4.	1 yr. = $\underline{\;?\;}$ wk.	$1\frac{1}{2}$ hr. = $\underline{\;?\;}$ min.	1 oz. = $\underline{\;?\;}$ lb.
5.	$\frac{1}{2}$ yr. = $\underline{\;?\;}$ wk.	1000 lb. = $\underline{\;?\;}$ ton	$\frac{2}{3}$ doz. = $\underline{\;?\;}$ things
6.	1 mi. = $\underline{\;?\;}$ ft.	$\frac{3}{4}$ yr. = $\underline{\;?\;}$ mo.	$\frac{5}{6}$ doz. = $\underline{\;?\;}$ things
7.	$\frac{1}{2}$ mi. = $\underline{\;?\;}$ ft.	2 pt. = $\underline{\;?\;}$ gal.	.5 lb. = $\underline{\;?\;}$ oz.
8.	1 bu. = $\underline{\;?\;}$ pk.	1 sq. ft. = $\underline{\;?\;}$ sq. yd.	.5 yd. = $\underline{\;?\;}$ in.
9.	20 in. = $\underline{\;?\;}$ ft.	18 in. = $\underline{\;?\;}$ ft.	.5 hr. = $\underline{\;?\;}$ min.
10.	6 in. = $\underline{\;?\;}$ ft.	24 in. = $\underline{\;?\;}$ yd.	$\frac{1}{2}$ sq. ft. = $\underline{\;?\;}$ sq. in.
11.	18 in. = $\underline{\;?\;}$ yd.	1 pk. = $\underline{\;?\;}$ bu.	10 sq. yd. = $\underline{\;?\;}$ sq. ft.
12.	8 in. = $\underline{\;?\;}$ ft.	$\frac{1}{2}$ min. = $\underline{\;?\;}$ sec.	$\frac{1}{2}$ sq. yd. = $\underline{\;?\;}$ sq. ft.

13. Jane needs 12 in. of lace and 18 in. of lace; so she needs $\underline{\;?\;}$ in. in all.

At 24¢ a yard what will it cost?

14. Allowing 4 min. to do each arithmetic problem, can John do 10 problems in $\frac{3}{4}$ hr.?

15. From 9:00 A.M. until 3:45 P.M. is $\underline{\;?\;}$ hours.

16. Allowing $\frac{1}{3}$ pt. of ice cream to a serving, how many servings are there in a quart?

How many in a gallon?

17. Jack's school vacation lasts from June 1 to September 1. What part of a year is that?

18. To cover a floor $10' \times 18'$ requires $\underline{\;?\;}$ sq. yd. of linoleum.

Multiplying by mixed numbers

1. Ted wanted to know how much it would cost to cement the game-room floor in his home at \$2.40 a square yard.

▶ He measured and found the floor to be 5 yards by $6\frac{1}{2}$ yards. Can you find the area of the floor?

▶ He multiplied $6\frac{1}{2}$ by 5 to find the area. He first thought, "$5 \times \frac{1}{2} = 2\frac{1}{2}$; then $5 \times 6 = 30$. $30 + 2\frac{1}{2} = 32\frac{1}{2}$ (sq. yd.)."

▶ Ted decided that it would cost $32\frac{1}{2} \times \$2.40$ to lay the cement floor. Was that right?

▶ He multiplied \$2.40 by $32\frac{1}{2}$ and decided that it would cost \$78.00. Check his work.

$$\begin{array}{r} 6\frac{1}{2} \\ \times\ 5 \\ \hline 2\frac{1}{2} \\ 30 \\ \hline 32\frac{1}{2} \end{array} \qquad \begin{array}{r} \$2.40 \\ \times\ 32\frac{1}{2} \\ \hline 120 \\ 480 \\ 720 \\ \hline \$78.00 \end{array}$$

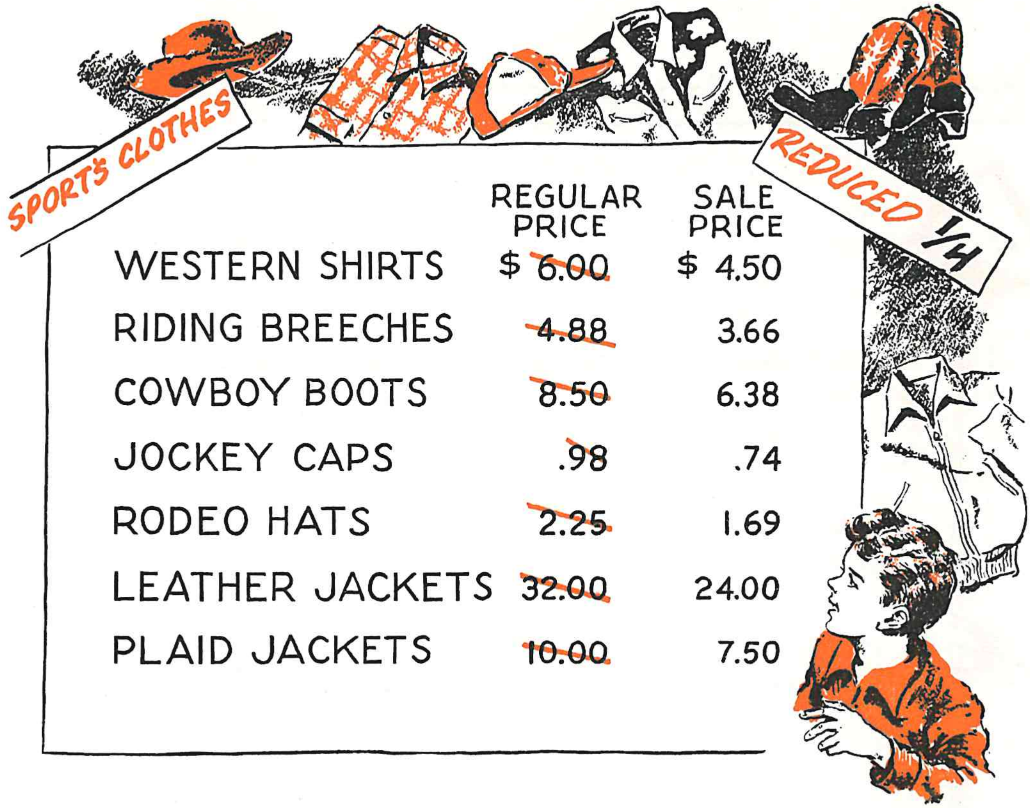
2. At \$2.40 a square yard, what would it cost to lay a cement floor 4 yards by $5\frac{2}{3}$ yards? Are these the correct multiplications you would need to do in order to find out? ⟶

$$\begin{array}{r} 5\frac{2}{3} \\ \times\ 4 \\ \hline 3)8 \\ 2\frac{2}{3} \\ 20 \\ \hline 22\frac{2}{3} \end{array} \qquad \begin{array}{r} \$2.40 \\ \times\ 22\frac{2}{3} \\ \hline 3)480 \\ 160 \\ 480 \\ 480 \\ \hline \$54.40 \end{array}$$

3. At \$2.40 a square yard, what would it cost to cement a floor 5 yd. by $5\frac{1}{4}$ yd.? 3 yd. by $7\frac{1}{2}$ yd.? 2 yd. by $4\frac{1}{4}$ yd.?

Multiply:

	a	*b*	*c*	*d*	*e*	*f*
4.	\$3.50 × $8\frac{2}{3}$	\$2.75 × $2\frac{3}{4}$	\$1.90 × $5\frac{2}{3}$	\$2.25 × $8\frac{2}{3}$	\$1.50 × $2\frac{3}{4}$	\$1.75 × $3\frac{3}{4}$
5.	\$2.50 × $16\frac{1}{2}$	\$5.25 × $15\frac{2}{3}$	\$2.20 × $12\frac{1}{2}$	\$5.50 × $15\frac{3}{4}$	\$3.50 × $16\frac{3}{8}$	\$6.50 × $23\frac{3}{4}$
6.	\$4.75 × $12\frac{3}{4}$	\$6.50 × $17\frac{7}{8}$	\$4.50 × $16\frac{3}{4}$	\$7.50 × $12\frac{3}{4}$	\$4.95 × $11\frac{2}{3}$	\$3.75 × $13\frac{3}{4}$
7.	\$3.90 × $12\frac{5}{8}$	\$4.90 × $14\frac{2}{3}$	\$2.70 × $13\frac{2}{3}$	\$3.10 × $15\frac{3}{8}$	\$3.95 × $12\frac{3}{4}$	\$2.75 × $12\frac{3}{8}$



	REGULAR PRICE	SALE PRICE
WESTERN SHIRTS	$ ~~6.00~~	$ 4.50
RIDING BREECHES	~~4.88~~	3.66
COWBOY BOOTS	~~8.50~~	6.38
JOCKEY CAPS	~~.98~~	.74
RODEO HATS	~~2.25~~	1.69
LEATHER JACKETS	~~32.00~~	24.00
PLAID JACKETS	~~10.00~~	7.50

Price reduced

1. Check the sale prices above to see if $\frac{1}{4}$ has been taken off the regular price of each article.

2. The regular price of a pair of shoes is \$4.60. What will the sales price be if $\frac{1}{4}$ is taken off the regular price?

3. The regular price of a hat is \$2. If $\frac{1}{5}$ is taken off the regular price, what will be the sale price?

4. How much will you pay for a coat regularly priced at \$24 if you pay $\frac{3}{4}$ of that price for it?

5. One store offered its goods for sale at $\frac{1}{3}$ off the regular price. Another store offered its goods for sale at $\frac{1}{4}$ off the regular price.

Which store was making the greater cut in prices?

6. The regular price of a bathing suit is \$5.00. How much will it cost at a sale if it is sold at $\frac{1}{5}$ off the regular price?

7. Bring to school advertisements of sales, and see how many problems you can make about each of them.

Which solution do you like?

▶ Janet made 20 bird houses. They cost her 75¢ each. She sold them at \$1.00 each. How much did she gain?

Which of these solutions do you like better?

FIRST SOLUTION

She paid 20 × \$.75 = \$15
She got 20 × \$1.00 = \$20
Gain: \$20 − \$15 = \$5

SECOND SOLUTION

Gain on each:
\$1.00 − \$.75 = \$.25
Gain: 20 × \$.25 = \$5

▶ Jack wanted to buy 20 chicks. He could get young ones at 10¢ each or some older ones at 12¢ each.

At first he thought he would buy the 10-cent kind. Then he wondered how much more 20 of the 12-cent kind would cost.

Which of these solutions do you like better?

FIRST SOLUTION

Cost of 20 chicks at 10¢ each: 20 × 10¢ = \$2.00
Cost of 20 chicks at 12¢ each: 20 × 12¢ = \$2.40
Total difference in cost: \$2.40 − \$2.00 = \$.40

SECOND SOLUTION

Difference in cost per chick: 12¢ − 10¢ = 2¢
Total difference in cost: 20 × 2¢ = 40¢

Can you think of two ways to do each of these problems?

1. Harry's brother bought 50 newspapers at $1\frac{1}{2}$¢ each and sold them at 2¢ each.

How much did he gain on each paper? on all the papers?

2. James bought 30 balloons at 6¢ each and sold them at the Field Meet for 10¢ each.

How much did he gain?

3. Bob bought 15 apples for 30¢. He sold them for 3¢ each at a baseball game.

How much did he gain?

4. Mary Ann bought a package of 25 white cards for 10¢. She painted designs on them and sold them for place cards at 3¢ each.

How much did she gain?

Review

1. To be added or subtracted, fractions must have a common __?__.

2. How do you change a fraction into a fraction with a smaller denominator? into a fraction with a larger denominator? Illustrate.

3. Make some kind of drawing to show that $1\frac{3}{4} = \frac{7}{4}$; $\frac{3}{6} = \frac{1}{2}$.

4. How can any mixed number be changed to an improper fraction? Illustrate.

5. How can any improper fraction be changed to a mixed number? Illustrate.

6. Suppose you make the denominator of any fraction, say $\frac{3}{4}$, larger, and don't change its numerator. Then the fraction becomes __?__. Illustrate.

7. Suppose you make the numerator of any fraction, say $\frac{3}{4}$, larger, and don't change the denominator. Then the fraction becomes __?__. Illustrate.

	a	*b*	*c*	*d*	*e*	*f*	*g*
8.	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{3}{4}$	$1\frac{3}{4}$	$5\frac{1}{6}$	$8\frac{7}{8}$	$3\frac{5}{8}$
	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{6}$	$2\frac{3}{8}$	$8\frac{2}{3}$	$3\frac{1}{2}$	$2\frac{1}{2}$
	$+\frac{3}{8}$	$+\frac{1}{3}$	$+\frac{1}{2}$	$+5\frac{1}{2}$	$+2\frac{1}{2}$	$+2\frac{1}{4}$	$+4$
9.	$\frac{3}{4}$	$\frac{5}{6}$	$2\frac{5}{6}$	$4\frac{1}{4}$	5	$6\frac{1}{4}$	$3\frac{1}{8}$
	$-\frac{1}{8}$	$-\frac{1}{4}$	$-1\frac{1}{3}$	$-2\frac{1}{2}$	$-3\frac{1}{5}$	$-2\frac{2}{3}$	$-2\frac{1}{3}$

	a	*b*	*c*	*d*	*e*	*f*
10.	$\frac{3}{5} \times 20$	$\frac{2}{3} \times 6$	$\frac{5}{6} \times 10$	$4\frac{1}{5} \times 12$	$8 \times \frac{3}{4}$	$\frac{2}{3}$ of 5
11.	32	\$3.25	560	742	202	460
	$\times 4\frac{2}{3}$	$\times 5\frac{1}{5}$	$\times 14\frac{3}{8}$	$\times 12\frac{3}{4}$	$\times 13\frac{1}{2}$	$\times 25\frac{2}{5}$

12. Which of the following mean $5 \div 8$?

$\frac{1}{5}$ of 8 $\quad$ $\frac{1}{8}$ of 5 $\quad$ $\frac{5}{8}$ $\quad$ $5\overline{)8}$ $\quad$ $8\overline{)5}$

13. In which pair of fractions is the first fraction larger than the second?

$\frac{1}{3}, \frac{2}{5}$ $\quad$ $\frac{5}{8}, \frac{3}{4}$ $\quad$ $\frac{6}{10}, \frac{1}{2}$

14. Which weight is $\frac{1}{2}$ pound more than $4\frac{3}{8}$ lb.?

$4\frac{7}{8}$ lb. $\quad$ $5\frac{1}{8}$ lb. $\quad$ $5\frac{3}{8}$ lb.

Arithmetic roundup

1. 67	**2.** \$5.06	**3.** 70509	**4.** \$893.97
86	.37	− 10860	− 209.88
54	9.84		
69	4.78	**5.** 869	**6.** 908
53	7.64	× 407	× 950

7. Arrange in order, beginning with the largest:

- $2\frac{1}{2}$ $\frac{9}{4}$ $\frac{21}{8}$ 2
- .5 .05 .15 1.5

8. Show that $9 \times \frac{3}{4}$ and $\frac{3}{4} \times 9$ are equal.

9. If the 6 in 3,687 were a zero, the number would be _?_ smaller.

10. Write in words: 9,050,300.

11. Write the Arabic numerals for CCLXI.

12. How many 9-cent melons can Joe get for \$1.17?

13. Which is nearest to $\frac{1}{2}$?

.40 .90 .05 .52 .16

14. At 40¢ a dozen, how much will 9 ears of corn cost?

15. The girls on a refreshment committee spent 75¢ for candy, 40¢ for a cake, and \$1.05 for ice cream.

If 6 girls share the cost equally, how much should each pay?

16. How far will a freight train travel in 24 hr. at an average rate of 32 mi. an hour?

17. Find $\frac{5}{6}$ of each of these:

24 54 72 48 18

18. A piece of material contained $15\frac{1}{6}$ yd. How much was left after $3\frac{1}{4}$ yd. were sold?

19. Find the area of a rectangle $6' \times 8'$; find the perimeter.

20. At \$2.40 a square yard, what is the cost of linoleum for a floor that is 10 ft. by 14 ft.?

21. Divide 24,352 by 48.

22. Divide 11,578 by 96.

23. Does $\frac{1}{2} + \frac{1}{4}$ equal $.50 + .25$?

24. Suppose sheets of cardboard are .1 inch thick.

How many sheets are there in a pile 1 inch thick? in a pile 2 inches thick? in a pile 5 inches thick?

25. Take the tests on pages 305, 306, 307, and 308.

Problem-solving help

Roy is going fishing. He needs some fishhooks.

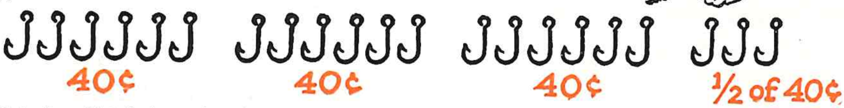
▶ At 6 for 40¢, how much will 18 fishhooks cost?

Think, "18 is 3 *sixes*. 3 *sixes* will cost 3 × 40¢, or \$1.20."

▶ At 6 for 40¢, how much will 3 fishhooks cost?

Think, "3 = $\frac{1}{2}$ of six. $\frac{1}{2}$ of six hooks will cost $\frac{1}{2}$ of 40¢, or 20¢."

▶ At 6 for 40¢, how much will 21 fishhooks cost?



Think, "21 is $3\frac{1}{2}$ *sixes*. $3\frac{1}{2}$ *sixes* cost $3\frac{1}{2}$ × 40¢, or \$1.40."

Draw pictures if you need help on these problems:

1. At 30¢ for 6 pansy plants, what will 24 plants cost? 30 plants? 36 plants? 39? 40?

2. At 3 for 10¢, what is the cost of 12 pepper plants? of 15 plants? of 18 plants?

3. At 4 for 15¢, what is the cost of a dozen zinnia plants? of 2 dozen plants? of 2 plants?

4. At 6 for 25¢, how much will a dozen and a half marigold plants cost? 2 dozen? $2\frac{1}{2}$ dozen? 3 dozen?

5. At 8 for a quarter, what is the cost of 4 petunia plants? of 16 plants? of 2 plants?

6. At 20¢ a dozen, how much will 15 aster plants cost? 18? 21?

7. At 4 for 29¢, how much will 8 berry bushes cost? a dozen? 1?

8. At 40 cents a dozen, how much will 6 lily bulbs cost? 4 bulbs? 1 bulb?

9. At \$2 a dozen, how much will 3 peony plants cost? 6? 18? 21?

Everyday problems

1. Billy paid \$15.00 for a second-hand bicycle. Then he bought 2 new tires at \$1.69 each, handle bars for 95¢, a new seat for \$1.85, a pair of pedals for \$1.10, and a pair of handle-bar grips for 29¢. He also spent \$1.25 for paint for the bicycle.

When he had the bicycle finished, it looked almost like new. How much did he spend on it all together?

2. John built a shelf $2\frac{1}{4}'$ long above the living-room fireplace. His mother asked him to build one for the kitchen twice as long.

How long should John make that shelf?

3. Mrs. Brown asked Milton to stain the porch floor. It is 12′ long and $6\frac{3}{4}'$ wide.

The storekeeper told him that he could figure the cost to be about 4¢ a square foot. Can you figure how much it would cost to stain the floor?

4. Elise bought a pound can of tea for 80¢ instead of buying a pound in 2-oz. packages at 12¢ each. How much did she save? (How many 2-oz. packages are there in 1 lb.?)

5. Mrs. Cross bought a remnant of net containing $9\frac{1}{8}$ yd. If she uses $2\frac{1}{2}$ yd. for Lloyd's bunk-room window curtain, how much will she have left for living-room curtains?

6. The Rodgers bought a $12\frac{3}{4}$-lb. ham at 60¢ a pound. How much did the ham cost?

7. Lois stopped at the bakery counter to buy a dozen rolls that cost 20¢ a dozen. The storekeeper had only 7 rolls left.

He said, "You may have these 7 for 10¢." Was that more or less than the regular price?

8. Elaine's recipe for orange marmalade says, "Weigh oranges and then add $\frac{3}{4}$ their weight in sugar."

Elaine found that her dozen oranges weighed 3 lb.; so she added _?_ lb. _?_ oz. of sugar.

9. Art saves $\frac{1}{4}$ of all the money he earns. Last month he earned \$2.89, \$3.50, \$4.65, and \$2.98.

How much did he save each week? How much did he save during the month? (Note: $\frac{1}{4}$ of \$2.89 = \$.72$\frac{1}{4}$. In a case like that, Art saves \$.72.)

Be your own teacher

How many different ways can your class find to solve each of these problems?

1. Harold picked 3 boxes of strawberries in 15 minutes. At that rate, how many boxes of berries could he pick in an hour? in 2 hours?

2. Dorothy is folding paper napkins. She has been working 10 minutes and has folded 50 napkins. There are 150 more napkins to fold.

How much longer will Dorothy have to work?

3. Jane can buy 8 apples for 15¢. How much will she have to pay for 24 apples?

4. If 2 apples make enough salad to serve 3 persons, how many apples will Alma need to make salad for 6 persons?

5. Nancy paid 15¢ for a 4-ounce package of potato chips. At that rate, how much would $\frac{1}{2}$ pound of potato chips cost? How much would a pound cost?

6. James is setting out cabbage plants. He has set out 10 plants in 12 minutes. He has 90 more plants to set out. How much longer will he have to work?

7. Mary has offered to help James set out 90 plants. If Mary can work as fast as James (Ex. 6), how many plants can they both set out in 12 minutes?

How long will it take them together to set out 90 plants?

8. William found that in 30 seconds his pulse beat 42 times. How many times a minute was William's pulse beating?

The doctor told him that his pulse should beat 72 times a minute. His pulse was beating _?_ times a minute more than it should.

9. Martin timed himself while he did 10 examples in column addition. It took him 7 minutes.

At that rate, how long would it take him to do 20 such examples? 30? 40?

10. Tom has a sheet of cardboard 3 feet long and 2 feet wide. He wants to cut it into 4-inch squares.

Into how many of the squares can he cut the cardboard? Will there be any cardboard left over? Draw a diagram on the blackboard.

To the Teacher: See Note 2 on page 310.

Problem study

1. Horace is digging a trench 20 feet long in which to plant asparagus. He has finished digging $8\frac{2}{3}$ feet. How many more feet must he dig?

2. Nora wants to make 4 curtains. She needs 39 inches of material for each curtain. How many inches does she need in all?

How many yards of material must she buy?

3. When the temperature is 23°, how many degrees below freezing is it?

4. A playground committee can buy a set of 6 swings for \$75. They can buy the materials and make 6 swings for \$59.32.

How much can they save by building the swings themselves?

5. Find the cost of 200 pineapples at $27\frac{1}{2}$¢ each.

6. Walter caught a fish that weighed 4 lb. After it was cleaned it weighed $2\frac{7}{8}$ lb. The fish lost __?__ lb. in the cleaning.

7. 35 children bought a package of colored paper containing 1000 sheets. They paid \$1.05 for it. What is each child's share of the paper? share of the cost?

8. Donald has \$.50. How much more does he need to buy $9\frac{2}{3}$ feet of plastic cord at 8¢ a foot?

9. Find the cost of $3\frac{3}{4}$ yd. of material at 50¢ a yard, and an 8-cent spool of thread.

10. Jane found a bag of pennies. She gave 17 to John and kept 24 herself. Do you know how many pennies she found?

11. At 20 cents a pound, find the cost of a cantaloupe weighing 1 lb. 8 oz.

12. Each of the 13 members of a tennis club pays \$.75 a month dues. This month the expenses of the club are \$11.96.

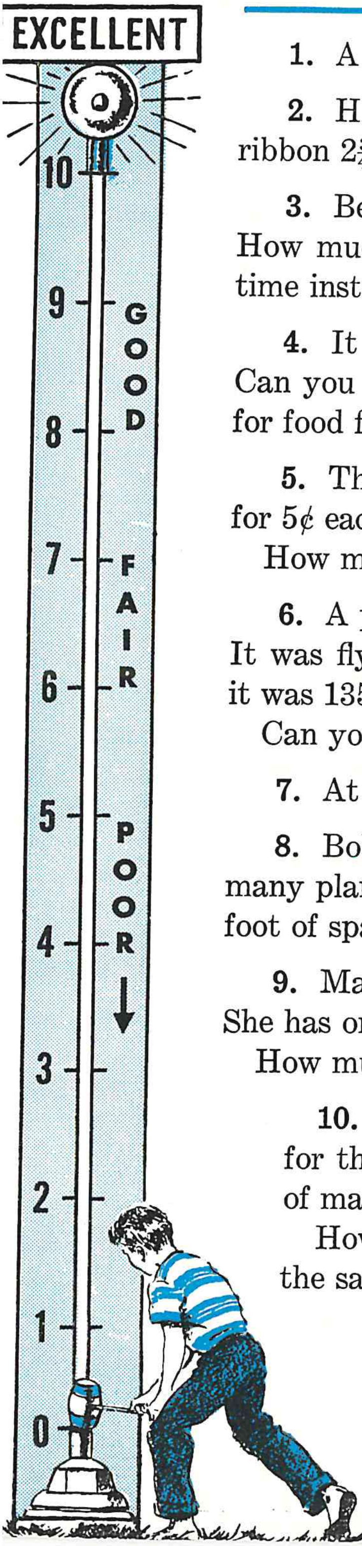
How much more than his regular dues should each member pay this month to cover the expenses?

13. Ralph, Randy, and Vernon are building a boat. Ralph has spent \$9.80 for materials, Randy has spent \$7.45, and Vernon has spent \$4.35. How much have they spent on the boat?

They want to share the cost equally. What is each one's share of the cost? Which boys have spent more than their share?

What should Vernon do so that the boys share the cost equally?

Problem Test 8



1. A "150-yd. dash" is how many feet long?

2. How many 9″ lengths can be cut from a piece of ribbon $2\frac{3}{4}$ yd. long? ($2\frac{3}{4}$ yd. = _?_ in.)

3. Bert can buy pencils at 5¢ each, or at 50¢ a dozen. How much will he save if he buys a dozen pencils at one time instead of buying them one at a time?

4. It has cost Hugh $37.80 to feed his calf for a year. Can you tell how much he spends a month on the average for food for his calf?

5. Three girls sold 45 apples at a roadside fruit stand for 5¢ each.
How much should each receive if they share equally?

6. A plane was reported flying over an airport at noon. It was flying directly westward. Forty-five minutes later it was 135 miles farther west.
Can you find its average rate of flying per minute?

7. At 3 for a nickel, find the cost of 10 notebook rings.

8. Bob's square garden plot is 10 feet on a side. How many plants should he set out if each plant needs 1 square foot of space?

9. Marie needs $6\frac{1}{2}$ cupfuls of sugar for marmalade. She has only $4\frac{3}{4}$ cupfuls.
How much more sugar does she need?

10. Pete and Jack are making waterproof awnings for their cabin at Mountain Lake. They need $2\frac{3}{8}$ yd. of material for 1 window.
How much material should they buy for 3 windows the same size?

Write your score on your Problem Test Record.

Self-Help Test 22

Divide and check:

1. $23\overline{)87}$ **(80)**
2. $68\overline{)5732}$ **(127–129)**
3. $24\overline{)4824}$ **(188–189)**
4. $42\overline{)345}$ **(81)**
5. $46\overline{)9876}$ **(173–174)**
6. $54\overline{)36180}$ **(191)**
7. $31\overline{)946}$ **(88–92)**
8. $28\overline{)8456}$ **(188–189)**
9. $49\overline{)2903}$ **(196)**
10. $82\overline{)6050}$ **(96–97)**
11. $58\overline{)40774}$ **(189)**
12. $25\overline{)\$32.75}$ **(192)**

Self-Help Test 23

Watch the signs!

1. $\frac{1}{4} + \frac{2}{4}$ **(136)**
2. $\frac{2}{5} + \frac{1}{10}$ **(148)**
3. $3\frac{1}{6} - \frac{5}{6}$ **(233)**
4. $\frac{1}{2} - \frac{2}{6}$ **(146)**
5. $\frac{1}{2} - \frac{1}{4}$ **(146)**
6. $5\frac{2}{3} + 1\frac{1}{2}$ **(218)**
7. $4\frac{3}{8} - \frac{1}{4}$ **(152)**
8. $1\frac{7}{12} + 4\frac{3}{4}$ **(223)**
9. $\frac{5}{6} + \frac{1}{3}$ **(145)**
10. $4\frac{3}{4} + 2\frac{1}{2}$ **(218)**
11. $3\frac{1}{3} - \frac{1}{2}$ **(234)**
12. $8\frac{1}{4} - 3\frac{1}{3}$ **(234)**
13. $1 - \frac{5}{7}$ **(232)**
14. $7 - \frac{7}{8}$ **(232)**
15. $4\frac{3}{4} + 2\frac{1}{3} + \frac{1}{12} = \underline{\ ?\ }$ **(223)**
16. $\frac{28}{8} = \frac{8}{8} + \frac{8}{8} + \frac{8}{8} + \underline{\ ?\ }$ **(45)**
17. $\frac{1}{2} - \frac{1}{3}$ **(215–216)**
18. $.4 + .5 + .6$ **(274)**
19. $.20 + .4 + .65$ **(274)**
20. $2.8 - 1.6$ **(275)**
21. $.75 - .26$ **(275)**
22. $3.20 - .17$ **(275)**

Self-Help Test 24

1. At 6 for 10¢, how much will 9 muffins cost? **(297)**

2. At 6 for 10¢, how much will 4 muffins cost? **(297)**

3. What is the area of a garden plot 20′ long and 12′ wide? **(248)**

4. How many square yards of surface are there to be painted in a hall floor that is 24′ long and 8′ wide? **(249)**

5. How many square feet are there in the floor of a pony stall that contains 9 sq. yd.? **(249)**

6. Find the cost of a 9-ounce slice of ham if ham is selling at 96¢ a pound. **(171)**

7. In 5 bowling games at Community Center, Harry scored 80, 78, 66, 92, and 84. What was his average score? **(181)**

8. If Paul uses a scale of $\frac{1}{4}''$ to 5′ in making his diagram of a camp, a line 2″ long will represent _?_ feet. **(263–264)**

9. At \$2.15 a square yard, how much will it cost to cement a floor 3 yd. by $3\frac{1}{2}$ yd.? **(292)**

10. The regular price of a hat is \$3. What will be the sale price of the hat if the price is reduced one fourth? **(293)**

11. Joe bought $12\frac{3}{4}$ pounds of hamburger for his Scout Troop picnic. The hamburger cost 51 cents a pound.

How much did he pay for the $12\frac{3}{4}$ pounds? **(292)**

12. John, Larry, and Joe want to share equally $\frac{3}{4}$ lb. of putty. What part of a pound will each get? $\frac{1}{3}$ of $\frac{3}{4}$ = _?_. **(289)**

Self-Help Test 25

1. $8 \times \frac{4}{6}$ **(279–280)**

2. $\frac{5}{8}$ of 16 **(285)**

3. $\frac{4}{5}$ of 16 **(285)**

4. $\frac{2}{3} \times 18$ **(286)**

5. $\frac{1}{2}$ of $\frac{1}{4}$ **(290)**

6. $4 \times 3\frac{1}{2}$ **(282)**

7. $\begin{array}{r} 3\frac{1}{3} \\ \times\ 4 \\ \hline \end{array}$ **(281)**

8. $\begin{array}{r} 30 \\ \times\ 5\frac{2}{3} \\ \hline \end{array}$ **(287)**

9. $\begin{array}{r} 32 \\ \times\ 6\frac{4}{5} \\ \hline \end{array}$ **(288)**

10. $\begin{array}{r} \$3.20 \\ \times\ 2\frac{3}{8} \\ \hline \end{array}$ **(292)**

Measuring your growth in arithmetic

Work carefully. Check your answers. Be sure each answer is sensible.

1. Bertha needs 4 pieces of oilcloth, each $\frac{3}{4}$ yd. long, to make four waterproof bags for carrying wet bathing suits.

How many yards of oilcloth should she buy?

2. What is $14 \times \frac{4}{5}$?

3. Multiply 32 by $6\frac{3}{4}$.

4. Multiply $12\frac{2}{3}$ by 8.

5. Find $\frac{5}{6}$ of 15.

6. Draw a diagram to show that $\frac{1}{4}$ of $\frac{1}{2} = \frac{1}{8}$.

7. At \$1.50 a yard, what will be the cost of a piece of material $4\frac{1}{2}$ yd. long?

8. Sam saw a pair of frontier pants marked \$6.00. He is wondering how much they will sell for at the "$\frac{1}{4}$ off" sale. How much do you think they will be marked then?

9. Peter wanted to buy some fish bait. He saw a sign that read "Grasshoppers, 10¢ a doz." He figured he would pay __?__¢ for 30 grasshoppers.

10. The Lucas boys are putting up shelves for their books. The space is $3\frac{3}{4}'$ wide, and there is room for four shelves. How many feet of lumber will they need for four shelves?

Just for fun

1. John wrote a number using 2 figures. He multiplied the number by 6. His answer was 9.

What was the number John wrote at first?

2. Tony wrote a number using 3 figures. He multiplied the number by 8. His answer was 18.

What was the number he wrote at first?

3. Mary wrote a number using 2 figures. Then she found what $\frac{1}{2}$ of the number was. Her answer was $\frac{1}{4}$.

What was the number she wrote at first?

4. If you can do Exs. 1–3, you may enjoy making up some number tricks of the same kind to ask your friends.

Addition facts

Say the answers to these addition examples. Then try to write all the answers on folded paper in 4 minutes. If you make an error, study the example and take the test again. Practice until you can write every answer in 4 minutes.

1.	7	2	2	2	4	4	3	1	9
	1	9	5	8	4	1	1	8	9
2.	7	6	5	3	1	9	8	1	1
	7	1	4	3	1	2	8	3	6
3.	1	2	5	2	7	1	8	6	3
	7	1	5	2	2	9	1	2	6
4.	2	4	8	8	6	1	9	6	3
	4	5	3	2	4	4	1	6	2
5.	4	1	2	9	6	3	3	3	2
	3	5	6	3	5	8	4	9	3
6.	3	6	7	2	8	4	5	4	1
	5	3	3	7	4	8	2	2	2
7.	5	5	8	7	5	9	6	6	5
	3	1	5	9	8	7	8	9	7
8.	7	8	9	5	8	8	4	7	4
	8	7	6	9	9	6	7	5	9
9.	9	9	6	5	4	7	7	9	3
	5	4	7	6	6	6	4	8	7

Subtraction facts

Say the answers to these subtraction facts. Then try to write all the answers on folded paper in 5 minutes. If you make an error, study the example and take the test again. Practice until you can write every answer in 5 minutes.

1.	7	4	5	8	6	6	2	5	6	3
	1	3	5	4	5	1	1	2	3	1
2.	5	1	8	4	6	9	4	9	9	5
	4	1	1	2	6	8	4	1	9	3
3.	9	8	10	3	3	7	5	7	12	10
	6	2	4	3	2	7	1	2	6	7
4.	8	11	8	9	7	8	4	2	7	6
	6	2	8	3	3	7	1	2	5	4
5.	10	6	10	7	9	11	9	10	10	14
	1	2	2	6	5	8	2	3	9	7
6.	11	13	15	8	11	8	12	10	10	12
	7	6	8	5	5	3	9	5	6	4
7.	10	7	12	14	13	16	14	17	9	9
	8	4	8	9	4	9	5	9	7	4
8.	16	13	13	11	14	15	17	15	13	13
	7	7	8	3	6	9	8	7	9	5
9.	11	11	16	18	11	12	15	14	12	12
	4	6	8	9	9	3	6	8	5	7

Multiplication facts

Say the answers to these multiplication examples. Then try to write all the answers on folded paper in 5 minutes. If you make an error, study the example and take the test again. Practice until you can write every answer in 5 minutes.

1.	7	2	2	2	4	4	3	1	9
	1	9	5	8	4	1	1	8	9
2.	7	6	5	3	1	9	8	1	1
	7	1	4	3	1	2	8	3	6
3.	1	2	5	2	7	1	8	6	3
	7	1	5	2	2	9	1	2	6
4.	2	4	8	8	6	1	9	6	3
	4	5	3	2	4	4	1	6	2
5.	4	1	2	9	6	3	3	3	2
	3	5	6	3	5	8	4	9	3
6.	3	6	7	2	8	4	5	4	1
	5	3	3	7	4	8	2	2	2
7.	5	5	8	7	5	9	6	6	5
	3	1	5	9	8	7	8	9	7
8.	7	8	9	5	8	8	4	7	4
	8	7	6	9	9	6	7	5	9
9.	9	9	6	5	4	7	7	9	3
	5	4	7	6	6	6	4	8	7

Division facts

Give orally the answers to these division examples. Then try to write all the answers on folded paper in 6 minutes.

If you make a mistake in any example, study it and take the test again a few days later. Keep practicing until you can write every answer correctly in 6 minutes.

1.	$4\overline{)4}$	$6\overline{)18}$	$5\overline{)5}$	$8\overline{)48}$	$2\overline{)10}$	$3\overline{)18}$	$6\overline{)54}$	$9\overline{)45}$	$1\overline{)6}$
2.	$3\overline{)21}$	$2\overline{)2}$	$6\overline{)48}$	$4\overline{)28}$	$4\overline{)32}$	$9\overline{)36}$	$6\overline{)24}$	$8\overline{)64}$	$3\overline{)24}$
3.	$4\overline{)36}$	$6\overline{)42}$	$6\overline{)30}$	$2\overline{)8}$	$2\overline{)4}$	$8\overline{)72}$	$1\overline{)9}$	$3\overline{)27}$	$6\overline{)36}$
4.	$3\overline{)12}$	$1\overline{)7}$	$9\overline{)18}$	$7\overline{)56}$	$1\overline{)5}$	$7\overline{)35}$	$4\overline{)8}$	$9\overline{)27}$	$5\overline{)30}$
5.	$2\overline{)18}$	$1\overline{)4}$	$5\overline{)25}$	$8\overline{)8}$	$7\overline{)28}$	$4\overline{)12}$	$5\overline{)10}$	$5\overline{)35}$	$3\overline{)3}$
6.	$9\overline{)81}$	$7\overline{)42}$	$3\overline{)6}$	$8\overline{)16}$	$9\overline{)9}$	$4\overline{)16}$	$7\overline{)21}$	$2\overline{)16}$	$1\overline{)2}$
7.	$7\overline{)49}$	$5\overline{)40}$	$8\overline{)24}$	$3\overline{)9}$	$5\overline{)20}$	$2\overline{)14}$	$7\overline{)14}$	$1\overline{)8}$	$5\overline{)45}$
8.	$9\overline{)72}$	$7\overline{)7}$	$9\overline{)63}$	$6\overline{)6}$	$8\overline{)32}$	$9\overline{)54}$	$7\overline{)63}$	$2\overline{)6}$	$5\overline{)15}$
9.	$4\overline{)20}$	$1\overline{)1}$	$6\overline{)12}$	$8\overline{)40}$	$8\overline{)56}$	$2\overline{)12}$	$1\overline{)3}$	$4\overline{)24}$	$3\overline{)15}$

Tables of measurement

Length

12 inches (in.) = 1 foot (ft.)
3 feet = 36 inches = 1 yard (yd.)
$5\frac{1}{2}$ yards = $16\frac{1}{2}$ feet = 1 rod (rd.)
320 rods = 5280 feet = 1 mile (mi.)

Surface

144 square inches (sq. in.) = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)

Weight

16 ounces (oz.) = 1 pound (lb.)
100 pounds = 1 hundredweight (cwt.)
2000 pounds = 1 ton (T.)

Time

60 seconds (sec.) = 1 minute (min.)
60 minutes = 1 hour (hr.)
24 hours = 1 day (da.)
7 days = 1 week (wk.)
30 days = 1 month (mo.)

12 months = 1 year (yr.)
365 days = 1 year
366 days = 1 leap year
10 years = 1 decade
100 years = 1 century

Weekly means once a week.
Semiweekly means twice a week.
Biweekly means once every two weeks.
Monthly means once a month.
Semimonthly means twice a month.
Bimonthly means once every two months.

Annual means once a year.
Semiannual means twice a year.
Biannual means twice a year.
Biennial means once every two years.
Triennial means once every three years.
Perennial means year after year.

Liquid Measure

2 cups = 1 pint (pt.)
2 pints (pt.) = 1 quart (qt.)
4 quarts = 1 gallon

Dry Measure

2 pints = 1 quart
8 quarts = 1 peck (pk.)
4 pecks = 1 bushel (bu.)

To the teacher

This series is planned to develop progressively the important concepts, relationships, and computational skills needed in arithmetic. In doing this, the books of the series organize the learning into a meaningful system of related ideas; they make maximum use of children's needs for number; and they provide the practice, self-diagnosis, and remedial work required to make learning permanent. Most careful attention has been given to the problem of reading for understanding. The books are the outcome of years of research and classroom experience.

For the textbook for each grade there is available a *Teacher's Guide*. The *Guide* contains concrete suggestions for making the learning of arithmetic meaningful and interesting. It provides helps for utilizing the textbook material most effectively. It also gives a concise statement of the authors' philosophy and psychology of teaching.

NOTE 1 (*Pages 46, 133–143*). Pages such as these are designed to give children ability to visualize fractional relationships. All answers should be obtained by use of the diagrams. Do not introduce conventional methods of computing in doing these exercises.

NOTE 2 (*Pages 47, 107, and 299*). On these pages, entitled "Be your own teacher," are exercises designed to help children realize that they can without teacher or book guidance think out for themselves solutions to arithmetic situations that are new to them. Pupils will of course use a great variety of methods of solving the problems. Seldom will they use conventional methods. These pages will be welcomed by the teacher who wishes to challenge her more able pupils to do independent, creative, quantitative thinking. The solutions offered should be compared and evaluated by the participating pupils. Do not attempt to teach conventional methods.

NOTE 3 (*Pages 51, 70*). The letter N is used on pages such as these in place of the expression "what number." Do not let your former training in algebra mislead you into giving pupils algebraic rules for solving equations. The N as used in these exercises gives children practice in understanding the inverse relationship of multiplication and division, and the inverse relationship of addition and subtraction.

NOTE 4 (*Page 61*). The "First Way" of dividing shown on this page is the meaningful, sensible way. The "Second Way" is the mature, conventional way. Even though the First Way is new to you, do not skip it and hasten pupils into the conventional Second Way. Pupils cannot understand what they are doing in the Second Way without having previously learned the First Way.

NOTE 5 (*Pages 72–81*). This development of division (2-figure divisors) stresses meaning and judgment as preparation for the conventional technique of dividing. This unit gives practice in understanding the operation. The more emphasis you place upon the meaning of the process of division, the less trouble the pupil will have in performing it.

NOTE 6 (*Page 143*). A chart similar to the one on this page should be drawn on a large sheet of oak tag or on the blackboard and should be used for daily practice in visualizing the addition, subtraction, and equating of halves, fourths, eighths, and sixteenths.

NOTE 7 (*Page 268*). Units 31 and 33 indicated as "Optional" suggest to the teacher material that she can omit if she teaches in a short-term school or has a slow-learning group.

IN APPRECIATION

The authors are indebted to numerous teachers and elementary school pupils, and especially to Miss Ruth Baldwin and Miss Monica Hoye.

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